The Engineer.

Established 1856.

Registered as a Newspaper.

OFFICE FOR ADVERTISEMENTS & PUBLICATION, 28, ESSEX ST., STRAND, LONDON, W.C. 2.

VOL. CLII.—No. 3940] LONDON: FRIDAY EVENING, JULY 17, 1931 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES.

Stores Officers in the ROYAL AIR FORCE.

APPLICATIONS are INVITED from well-educated young MEN, between 23 and 25 on the 1st January, 1932, who have had five years' business experience in a firm of standing, to SIT at the EXAMINATION to be held in October next for the Grant of Permanent Commissions in the Stores Branch of the Royal Air Force.—Apply, SECRETARY (E.R.), Air Ministry, Kingsway, W.C. 2. 7254

The University of Sheffield.

SESSION 1931-32.

Vice-Chancellor: A. W. PICKARD CAMBRIDGE, M.A., D.Litt.

DEPARTMENTS OF MECHANICAL, ELECTRICAL, AND CIVIL ENGINEERING, METALLURGY, MINING, FUEL TECHNOLOGY, AND GLASS TECHNOLOGY.

The Courses in the above Departments extend over three or four years and prepare students to become specialists in one or other of these branches of Applied Science.

The LECTURE COURSES in all the Departments are supplemented by Practical Training in Laboratories and Workshops, which are fully equipped for the purpose of advanced scientific teaching, investigation and research.

Part-time Courses are arranged for students who desire to take special portions of any of the regular Courses.

In Mining Engineering and in certain of the Courses in Mechanical and Electrical Engineering, and in Glass Technology, arrangements are made to enable students who come to the University from works or collieries to take six months' Courses of study at the University and six months' practice at the works or colliery each year for a period of four years. During the first year such students should spend three terms at the University.

RESEARCH Fellowships and Scholarships are awarded annually.

The LECTURE COURSES commence OCTOBER 7th, 1931.

The TECHNICAL LABORATORY COURSES commence SEPTEMBER 29th, 1931.

Particulars of Entrance and Research Scholarships available will be sent on application.

For further details of the Courses and for particulars of the Degrees, Associateships, Diplomas, and Certificates awarded on their successful completion, application should be made to

W. M. GIBBONS, Registrar.

7255

University of Bristol.

FACULTY OF ENGINEERING.

The University invites APPLICATIONS for the following POST :—

A LECTURESHIP in CIVIL ENGINEERING (GRADE II.). Salary £400.

Applications should reach the undersigned, from whom further particulars may be obtained, on or before Monday, July 27th.

WINIFRED SHAPLAND, Secretary and Acting Registrar.

7267

Administrative County of LONDON.

ISLE OF DOGS PUMPING STATION.

INCREASED PUMPING POWER, 1931.

The London County Council invites TENDERS for the SUPPLY and ERECTION at the Isle of Dogs Pumping Station, Stewart-street, Manchester-road, Poplar, E. 14, of TWO STORM WATER PUMPING SETS, each to consist of a Three-cylinder Gas or Heavy Oil Engine of not less than 250 B.H.P., coupled direct to either a Centrifugal or Mixed-flow Pump.

The specification, form of Tender, drawings, &c., in respect of the work may be obtained on application to the Chief Engineer, The Old County Hall, Spring-gardens, S.W. 1, on and after Friday, the 17th day of July, 1931, upon payment of £5 by cheque, draft, or money order to the order of the London County Council. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same.

Full particulars of the work may be obtained on personal application and the contract documents may be inspected before payment of the fee.

Remittances by post should be addressed to the Chief Engineer, The Old County Hall, Spring-gardens, S.W. 1. Personal inquiries at Room 2, No. 3, Warwick House-street, Cockspur-street, S.W. 1.

The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in "The London County Council Gazette."

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 24th August, 1931, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

MONTAGU H. COX, Clerk of the London County Council.

7258

Administrative County of LONDON.

The London County Council invites TENDERS for the EXECUTION of the undermentioned WORKS, viz.:—

(A) Supply, Delivery and Erection of Washing Machines.

(B) Supply, Delivery and Erection of Belt-driven Hydro Extractors,

at London County Council Hospitals, Institutions, &c.

The specification, form of Tender, &c., in respect of each of the above works may be obtained on application to the Chief Engineer, The Old County Hall, Spring-gardens, S.W. 1, on and after Wednesday, 15th July, 1931, upon payment in each case of £1 by cheque, draft, or money order to the order of the London County Council. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application, and the contract documents may be inspected before payment of the fee.

Remittances by post should be addressed to the Chief Engineer, The Old County Hall, Spring-gardens, S.W. 1. Personal inquiries at Room 2, No. 3, Warwick House-street, Cockspur-street, S.W. 1.

The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in "The London County Council Gazette."

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Thursday, 30th July, 1931, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

MONTAGU H. COX, Clerk of the London County Council.

7257

The Engineer

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PUBLIC NOTICES.

City and County of Kingston-UPON-HULL.

CITY ENGINEER'S DEPARTMENT.

TO PUBLIC WORKS CONTRACTORS.

UNEMPLOYMENT RELIEF WORKS.

The Corporation is prepared to receive TENDERS for a STEEL and REINFORCED CONCRETE BRIDGE in Marfleet-lane, over the London and North-Eastern Railway (Hull and Withernsea Branch), together with the CONSTRUCTION of a REINFORCED CONCRETE CULVERT and other WORKS in connection with same.

The work includes the Piling and Excavation for and the Building of the Abutment Walls, the Reinforced Floor and Parapet Walls of the Bridge; the Supply and Fixing in position of 84 Tons of Steel in Plates and Angle of Built-up Girders and Joists, and the Construction of a Reinforced Concrete Culvert and the Diversion of the Marfleet Drain.

Forms of Tender and other particulars may be obtained at the City Engineer's Office (Room 135).

Tenders, endorsed and addressed as directed on the forms of Tender, are to be delivered at the Town Clerk's Office before Noon on Monday, July 27th, 1931.

The acceptance of an offer will be subject to the observation by the contractor of the Corporation's Fair Wages and Local Labour Clause.

The Corporation does not bind itself to accept the lowest or any Tender.

By Order, H. HAMER, City Engineer.

Guildhall, Hull, 11th July, 1931. 7252

Surrey County Council.

HIGHWAYS AND BRIDGES DEPARTMENT.

TENDERS are INVITED for the SUPPLY of 12 No. SECOND-HAND BROAD-WHEELED DUMP CARTS of a capacity of not less than 2½ cubic yards. The carts are to be delivered to Caterham Station (Southern Railway), and all Tenders should be made on the prescribed form, which may be obtained from the County Engineer, County Hall, Kingston-on-Thames, and should be returned to him not later than Saturday, 25th July.

The Council do not bind themselves to accept the lowest or any Tender.

DUDLEY AUKLAND, Clerk of the Council.

County Hall, Kingston-on-Thames, 8th July, 1931. 7253

PUBLIC NOTICES.

The Chinese Government

PURCHASING COMMISSION.

The Commission are prepared to receive TENDERS from British Manufacturers for :—

8 MIKADO TYPE FREIGHT LOCOMOTIVES and TENDERS.

20 THIRD-CLASS BOGIE CARRIAGES.

Tender forms, general conditions and specifications can be obtained at the offices of the CONSULTING ENGINEERS, Messrs. Sandberg, 40, Grosvenor-gardens, London, S.W. 1.

The following fees, which are not returnable, will be charged for each set :—

Locomotives £1 0 0
Carriages £1 10 0

7269

The County of London Electric SUPPLY CO., LTD.

KENT TRANSMISSION SYSTEM.

33-KV OVERHEAD LINE.

The County of London Electric Supply Company, Limited, are prepared to receive TENDERS for the SUPPLY and ERECTION of a 33-kV OVERHEAD LINE in Kent.

Forms of Tender and specifications can be obtained by Overhead Line Contractors from the offices of the Company on or after Monday, 20th July, 1931, and on payment of a fee of £5 5s. for the first copy and £2 2s. for every subsequent copy. Sums paid for any number of copies up to three will be refunded on receipt of a bona fide Tender.

Sealed Tenders, endorsed "Tender for 33-kV Overhead Line," must be delivered, addressed to the CHAIRMAN and MANAGING DIRECTOR, The County of London Electric Supply Co., Ltd., County House, 46/47, New Broad-street, London, E.C. 2, not later than Noon on Monday, 10th August, 1931.

The Company do not bind themselves to accept the lowest or any Tender. 7251

The Civil Engineers Appointments BOARD, 8, Princes-street, Westminster, S.W. 1, acting under annual licence from the London County Council, invites INQUIRIES from EMPLOYERS SEEKING the SERVICES of PROFESSIONAL ENGINEERS, either as Assistants or in more responsible positions.

All those whose names are accepted for entry in the Board's Register for employment possess qualifications which have been attested by means of scientific examinations, practical training and experience. P1305

PUBLIC NOTICES.

The Derwent Valley Water BOARD.

HOLLOWAY BY-PASS PIPE.

The Derwent Valley Water Board is prepared to receive TENDERS for the LAYING of about 1300 YARDS of 47in. BITUMEN-LINED STEEL PIPES, near Holloway, Matlock, Derbyshire.

Copies of the specification, schedule of quantities and drawings may be obtained on application to Mr. S. B. Winser, M. Inst. C.E., Engineer to the Board, at these offices on and after Wednesday, July 15th, on payment of Three Guineas, which will be returned on receipt of a bona fide Tender and the documents furnished by him.

Sealed Tenders, enclosed in the envelope supplied with the documents, to be delivered not later than Nine o'clock on Wednesday morning, the 29th July.

The Board will not be bound to accept the lowest or any Tender.

O. B. STEWARD, Clerk to the Board.

Bamford, near Sheffield, 9th July, 1931. 7256

Metropolitan Borough of SHOREDITCH.

APPOINTMENT OF FITTER.

The Baths Committee of the Council of the Metropolitan Borough of Shoreditch invite APPLICATIONS for the APPOINTMENT of FITTER.

The wages will be at the rate of 1s. 9d. per hour, for a 47-hour week, and the working week is to include Sundays when required.

The appointment is an established one, and will be subject to the successful applicant satisfactorily passing a medical examination, and to the provisions of the Shoreditch and Other Metropolitan Borough Councils (Superannuation) Act, 1922, as amended by the London County Council (General Powers) Act, 1930.

Applications, which should be received not later than 12 Noon on Tuesday, the 28th July, and endorsed "Appointment of Fitter," should be addressed to the Baths Superintendent and Engineer, Hoxton Public Baths, Pitfield-street, N. 1.

R. CYRIL RAY, Town Clerk.

Shoreditch Town Hall, Old-street, E.C. 1. 15th July, 1931. 7274

Swansea and Merthyr Tydfil JOINT MENTAL HOSPITAL.

ENGINEERING CLERK OF WORKS.

The Swansea and Merthyr Tydfil Joint Mental Hospital Committee invites APPLICATIONS from competent Engineers for the APPOINTMENT of an ENGINEERING CLERK OF WORKS to supervise under the direction of the Committee's Consulting Engineer the Installation of Steam Boilers, Panel Heating, Hot Water Supply, Kitchen, Laundry, and other Plant, Electric Lighting, and Power Installation in the above-named Hospital now in course of erection in Swansea.

Salary £6 per week, and the appointment is determinable by one month's notice on either side.

Applications, endorsed "Engineering Clerk of Works," stating age, qualifications, present position, and particularly experience in supervising the installation of similar plant, together with copies of not more than three recent testimonials, must be addressed to and reach the undersigned not later than Thursday, the 23rd July, 1931.

H. L. LANG-COATH, Clerk to the Joint Committee.

The Guildhall, Swansea. 7249

SITUATIONS OPEN.

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

TO ADVERTISERS UNDER BOX NUMBERS IN THIS CLASSIFICATION.

For the benefit of applicants, the Proprietors are prepared to insert brief notices that vacancies are filled, upon receipt of notifications from the Advertisers. These notices (limited to one line) will be free of charge and co-operation is asked for.

ASSISTANT CIVIL ENGINEER WANTED. Must be a good Draughtsman and Surveyor.—Apply, stating training, experience and salary required, to THE SECRETARY, Trent Navigation Co., Wilford-street, Nottingham. P1332 A

ENGINEER SALESMAN for South Africa. Age about 30, preferably single. Must have thorough technical, practical and commercial knowledge of Electric Lifts. State age, experience and salary required.—Address, 7270, The Engineer Office. 7270 A

THE APPOINTMENT of a First-class STEEL and HEAT-TREATMENT EXPERT in a Steel Foundry in the Midlands is BEING CONSIDERED.

Experience of Acid and Basic Open Hearth Furnaces and of Tropenas Process essential.

State age, salary expected, and previous experience.

Applications, which will be treated with confidence, should be addressed to :

7278, The Engineer Office. 7278 A

DRAUGHTSMAN (MECHANICAL) WANTED for works 25 miles out of London.

Only keen, live men, able to work on own initiative and with proved experience of modern production methods need apply.

State concise details of experience, age, and salary expected.

Address, 7241, The Engineer Office. 7241 A

WANTED, LEADING TURBINE DRAUGHTSMAN for Marine Works, N.E. Coast.—Address, stating age, experience and salary required, 7277, The Engineer Office. 7277 A

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SITUATIONS OPEN (continued)

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FITTER and TURNER for Plant Maintenance and General Repairs in East London Works. Must be good all-round man. State experience, &c.—Address, 7272, The Engineer Office. 7272 A

SITUATIONS WANTED.

MECH., CONSTRUCTIONAL and RAILWAY ENGINEER SEEKS POST, design, works, commercial, positions held, good organiser; home or abroad; age 44, speaks Spanish.—Address, P1253, The Engineer Office. P1253 B

ENGINEER, 10 Years' Experience on Sales in London and surrounding counties, DESIRES POSITION as Sales Manager.—Address, P1322, The Engineer Office. P1322 B

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Address, P1319, The Engineer Office. P1319 B

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MECH. DRAUGHTSMAN (25) DESIRES IMMEDIATE POSITION. Technical training, 3 years shops, 6 years D.O., ex. refs., gears, pumps, plant lay-out, general experience. Disengaged. Full details on request.—Address, P1324, The Engineer Office. P1324 B

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22, Shakespeare House, 29-31, Oxford St., London.
P1290 I

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THE OWNER of PATENT No. 287,391, "Improvements in or relating to Domestic Appliances," is DESIROUS of ENTERING into ARRANGEMENTS by way of LICENCE or otherwise on reasonable terms for the purpose of EXPLOITING the same and ensuring its full development and practical working in this country.
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P1327 H

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For continuation of For Sale Advertisements see page 4.

A Seven-Day Journal

The Shannon Power Scheme.

THE long-expected statement explaining the circumstances which led to the resignation of Dr. McLaughlin, of the Shannon Electricity Supply Board, was recently made by Mr. McGilligan, the Minister for Commerce and Industries. The statement had to be made by way of a preface to an application to the Dail to sanction an advance to the Board amounting to £2,000,000 in addition to the £2,500,000 put at its disposal as working capital. Although Mr. McGilligan admitted that he was not in a position to give a full and clear account of the finances of the Board, he made it clear that the Board had already committed itself to an expenditure of something like £850,000 in excess of the £2,500,000 limit, most of the excess being represented by the undischarged liabilities of pre-existing electricity undertakings taken over by the Board and merged in the Shannon scheme. The reason why a complete explanation of the financial position could not be submitted to the Dail was that the Board's accounting and costing activities had not kept pace with the zeal manifested in rushing on with the distribution of the electric current. The Board's policy seemed to have been to secure a rapid increase in consumption of current without due consideration of the expenditure involved, and owing to the lack of proper estimating or costing accounts it was difficult to ascertain whether electricity had been sold at the proper price. The additional £2,000,000 applied for was required partly to meet the expenditure of £850,000 for which the Board had already incurred liability and partly to provide for further development. The Minister's statement naturally came as a shock to the Dail, but both Mr. De Valera, for the Republicans, and Mr. O'Connell, for Labour, pointed out that the Board's account of the position had not yet been heard. There has been no suggestion of any misapplication of the funds, but simply that the accounting work has been allowed to fall into arrears.

Trade with Russia.

REPLYING to questions in the House of Commons on Thursday, July 9th, Mr. Graham, the President of the Board of Trade, made a statement with regard to the Government's policy as to credits granted to Russia for machinery and ships bought in this country. He stated that in view of all the circumstances, particularly the existing glut of tonnage, the Government considered that State guarantees should not be granted for the building or sale of ocean-going vessels for whatever country they might be destined. The Lord Privy Seal had been in touch with the Soviet trade representative with a view to increasing British exports to the Soviet Union, and it had been arranged that the Export Credits Advisory Committee would be prepared to consider sympathetically applications for guarantees in respect of orders for heavy engineering material to be placed in the near future, subject to agreement with exporters about prices and provided that credits up to 30 months from the date of the order, including the period of manufacture, could be arranged. The Soviet representative, for his part, had agreed that in that case he was prepared to regard the question as to the length of credit as settled. In reply to further questions, Mr. Graham said that all cases in which it was proposed that credit should be given would be submitted to the Advisory Committee and that his statement with regard to ships covered ships at large. In this connection we are now able to state that, although it has already been reported that an order for eight cargo ships for Russia has been placed with a Japanese shipbuilding firm, it would be premature to assign the placing of such an order with any particular concern. The negotiations, however, are stated to be well advanced.

Opening of New Glasgow Dock.

LAST Friday, July 10th, the King opened the new Shieldhall dock at Glasgow, naming it the King George V. dock. The scheme for the extension to the docks and quays, of which this is a part, was first considered by the Clyde Trust about thirty-three years ago, but it was not until fifteen years later that Parliamentary powers were sought. The occurrence of the war brought about another delay and work was not started until 1924. The scheme of improvement involves the expenditure of £10,000,000, and for the purpose 643 acres of land between Shieldhall and Renfrew have been acquired. About 100 acres of this land is to be devoted to the building of new docks, of which the King George V. is the first. This dock is 350ft. wide and 2483ft. long, with a water area of 20 acres. As the entrance is set back from the river bank to give a clear width of 650ft., a further area of about 9 acres has been added to the river. The additional quayage provided totals 6450ft. Including the ground upon which the equipment is installed and the water area, the new dock covers an area of 56 acres. At L.W.O.S.T. the berths are designed to have a depth of 32ft. In order that the area might be developed the Govan-Renfrew road had to be diverted, and for a length of about two miles it has been set back 700 yards from the river. The opportunity was also taken to improve it. The dock is fully equipped with goods sheds and cranes, and railway tracks connecting it with the main Glasgow to Paisley line have been laid down. The cost of carrying out the scheme is estimated to have been £2,000,000, and as it will probably meet immediate requirements, the entire improvement scheme is not likely to be completed for some years to come.

Oxford-street Traffic Signals.

THE new traffic signals in Oxford-street have now been put into operation, and it is the intention of the Ministry of Transport that this method of control, by means of coloured lights, shall be continued over a period which will give it a full trial. The object of the system is the co-ordination of the movement of traffic at each successive crossing in such a manner as to enable the flow of traffic in Oxford-street to proceed at a predetermined speed. The traffic along Oxford-street is released in groups sufficiently far apart to enable cross traffic to cross the main thoroughfare at the junctions or to join the main system. The total length of the thoroughfare controlled by the signalling installation is 1¼ miles, and the traffic at twenty-one junctions is regulated by seventy-four signals. Whilst bells have been fitted to the signals for giving an audible warning of a change of signal, it is not proposed to use them unless they are found to be really essential. Drivers of vehicles are warned that it is not to their advantage to race between each set of signals, as vehicles which reach the next signal ahead too quickly will be checked there and may hamper the even flow of traffic by reason of the delay occasioned by re-starting. Pedestrians are advised to cross Oxford-street at the junctions controlled by signals whilst the east and west traffic is held up. For their assistance parallel white lines have been provided across the full carriageway at each of these junctions. We shall be glad to know why the equipment is of American origin when several British firms were in a position to supply it.

Paris Public Transports.

THE Société des Transports en Commun de la Région Parisienne, or, as it is invariably called, the S.T.C.R.P., which exploits the omnibus and tramway services in Paris and the Department of the Seine, under the control of the General Council of the Department, is not disposed to allow the public to remain under the impression that public transport motor vehicles are financially a hopeless failure. In view of the enormous deficit of the company, the General Council of the Seine refuses to renew the concession, and proposes to transfer it to a new company which has been formed by the Paris Metropolitan Railway Company. This would create a monopoly of the whole transport system throughout the Department, both surface and underground. The S.T.C.R.P. has issued a public statement setting forth the financial disabilities which, it claims, make the situation appear far worse than it really is. The finances are controlled by the Department of the Seine, which, besides imposing heavy social charges on the company in the form of specially low rates for certain categories of users, places to its debit heavy depreciations and capital charges that are alleged to be abnormal, and after deducting the numerous liabilities, which the company affirms are contrary to all recognised methods of commercial finance, the annual deficit is reduced to a figure that leaves hope of its being wiped out altogether. This statement is a protest against departmental methods, as was the manifesto of the railway companies a protest against the wasteful methods of State interference, and in both cases it is affirmed that no form of public transport service can be carried on satisfactorily unless initiative is left to the company which runs it.

A Proposed New Glasgow Graving Dock.

WE are given to understand that negotiations have been nearly completed by Barclay, Curle and Co., Ltd., of Glasgow, for an extensive dock construction scheme at Elderslie, Scotstoun. The projected graving dock, which is to have a length of 620ft. and an entrance width of 85ft., with a 28ft. depth over the sill at high water during ordinary spring tides, is to be built at the firm's Scotstoun Repair Works and West Shipbuilding Yard. The mouth of the dock will be about 300ft. from the present 525ft. long Elderslie dry dock, and will have a boundary line 300ft. from the centre of the river. The proposed new dock is to be equipped with up-to-date electric, pneumatic and hydraulic services, the area around it being specially arranged for the reception and handling of heavy machinery, for which suitable crane equipment will be provided. The site on which the new dock is to be built is bounded on the east by Yarrow and Co's Scotstoun yard, and on the west by the works of Drysdale and Co., Ltd., and the width of the river Clyde at this point is about 550ft. The scheme was originally brought forward in 1919, and has been carefully discussed in all its bearings, an important aspect being the possible effect of constructing the dock on the navigable channel of the river. When the plan has been formally approved by the Clyde Navigation Trustees, certain outstanding questions will remain to be settled. The project is a bold one, which, when completed, will add considerably to the already extensive facilities for ship repair and fitting out controlled by Barclay, Curle and Co., Ltd., through their various Clyde establishments.

A Scottish Colliery Merger.

A NEW company will be formed in the Ayrshire coalfield district if negotiations now proceeding are successfully terminated. The firms concerned are William Baird and Co., Ltd., the Sanquhar and Kirkconnel Collieries, Ltd., which has been associated with the first-named firm for some time, and the Dalmellington Iron Company, Ltd. It is stated officially that the negotiations now proceeding for the formation of the new company have reached an advanced stage. What is proposed is, apparently, not a purchase, but a merger of the interests of the firms concerned, which will involve the paying out in cash of the preference shareholders of the Dalmellington Iron Company, Ltd., in terms of the articles of association, and the issue to the ordinary shareholders, who may also receive a limited amount in cash, of shares in the new company. William Baird and Co., Ltd., have an authorised share capital of £3,100,000, and have extensive interests largely in Ayrshire in coal and iron. They also manufacture by-products of these minerals and have interests in the manufacture of cement. The Dalmellington Iron Company, Ltd., is an older concern, with an authorised capital of £500,000, engaged in the production of bricks and having interests in coal.

Salvage Operations at Scapa Flow.

ON the afternoon of Thursday of last week, July 9th, at 3.55 p.m., the 25,000-ton ex-German battleship "Prinz Regent Luitpold," which, since June 21st, 1919, has lain keel uppermost in Scapa Flow, with a list of 20 deg., in 18 fathoms of water, was successfully refloated upside down by Cox and Danks, Ltd. She is noteworthy as being, we believe, the largest ship to be raised from such a depth by the compressed air method. Work upon her was begun less than five months ago, and has been somewhat retarded by winter weather. In order to lift her on a fairly even keel, Mr. E. F. Cox decided to divide the hull compartments and machinery spaces into twelve watertight sections, to each of which an air lock 55ft. long, giving access to the hull, was attached and stayed with guy ropes. In order to carry out the necessary work of sealing up all openings and dividing bulkheads, it was necessary for the men to work at air pressures up to 32 lb. per square inch, depending on the position in the ship. Preliminary operations were begun on the Monday before the refloating, when the bow was lifted and again depressed to allow the stern to rise. As soon as the hull appeared above water, further air was pumped in, and within a little over an hour the ship was afloat and ready to be towed to Cava beach to await sale for breaking up. With her twelve air-locks protruding from the upturned hull, she presented a very unusual appearance. The firm is to be congratulated on the successful result of its endeavours, which have been personally supervised by Mr. E. F. Cox. Since 1924, when salvage operations in Scapa Flow were begun, three battle-cruisers, two battleships, a light cruiser and twenty-five destroyers have been raised.

New Thames Pleasure Steamer.

THE new pleasure steamer for the Thames estuary service of the General Steam Navigation Company, Ltd., the order for which has been placed with Cammell, Laird and Co., Ltd., of Birkenhead, will initiate a forward step in the design and layout of passenger accommodation. Work upon her will be started immediately, so that, if possible, she will be ready for the 1932 season. She will be a paddle steamer of 280ft. length, with a beam of 36ft. 6in. and a depth of 11ft. 6in., 20ft. shorter than the "Crested Eagle," with a 2ft. wider beam, but there will be four decks instead of three. The passenger accommodation will be larger than on any of the existing vessels in the service. The propelling machinery will follow conventional design, although the electric drive for the paddle wheels was, we understand, carefully considered. It has been decided to install engines of the usual triple-expansion inclined type, the output being about 3000 S.H.P., steam being raised at 200 lb. pressure in two oil-fired Scotch boilers, working with closed stokeholds. The new steamer will have a sloping stem and a tug-boat stern, with two masts, and her deck lounge, which will have a length of 130ft., and a sun deck above, will be designed in such a way that an uninterrupted promenade from stem to stern will be given. The improvements in hull design and passenger accommodation we have referred to have been made possible by the removal some time ago of the company's landing stage to a point below London Bridge, so that the height restrictions formerly imposed do not now apply. The design has been prepared in collaboration with the owners' consulting naval architect, Mr. William Gray, of Fenchurch-street.

The Royal Agricultural Show at Warwick.

No. III.*

THE Show at Warwick terminated on Saturday last. The attendance of the public had been even less satisfactory than at the preceding Manchester Show. The falling off was, no doubt, due, in some measure, to the unsettled weather conditions, before and during the Show. The recent outbreak of foot-and-mouth disease was also a contributory cause, as the display of cattle was smaller than usual, but the primary reason for the reduced attendances is the depression in trade, and the Council of the Royal Agricultural Society will be wise in future to reduce the charges for admission of the public to those which were in force prior to the war.

In view of the efforts that are being made to advance the claims of electricity as a source of power for farms and estates, it was fitting that the Electrical Development Association should be represented by a stand showing the numerous applications of electricity. Farmers, generally, have acquired a good deal of mechanical engineering knowledge during recent years, but electrical engineering is a subject with which they are not as yet very familiar, and they are, perhaps rightly, somewhat sceptical concerning some of the claims made by electrical engineers for the advantages possessed by electricity. Some figures which were presented by Mr. M. M. Harvey, Agricultural Development Officer of the Shropshire, Worcestershire and Staffordshire Electric Power Company, at a conference held on the Show ground will be found useful to farmers who are contemplating the adoption of this form of energy. With power based on a cost of 2d. per unit, Mr. Harvey claims that chaff cutting can be performed for 1s. per ton; root cutting, pruning and cleaning at 1d. per ton; threshing at about 1s. 6d. per ton; and sheep shearing at the rate of ten sheep per penny. For dairy purposes the use of electricity would appear to be equally economical for, according to Mr. Harvey, 50 lb. of butter, can be churned for 1d. and 20 gallons of milk can be cooled at a similar cost for current.

BARFORD AND PERKINS.

Amongst the appliances exhibited by Barford and Perkins, Ltd., Peterborough, were the two motor rollers illustrated in Figs. 20 and 21. That shown in Fig. 20 is specially designed for rolling narrow footpaths, tennis courts and small areas. The machine is driven by a 4 H.P. two-stroke petrol engine. The normal speed is 1½ m.p.h., both forward and reverse, but higher or lower speeds can be obtained by adjusting the throttle. The change of direction is easily accomplished by means of a lever which is moved from the neutral position in the direction it is desired to travel. The change is effected by friction clutches, which give an instantaneous reverse to the roller with absence of "jerk." The machine is easily manœuvred and can be turned in a 16ft. diameter circle. The rolling width is 30in. and the pressure per inch width is approximately the same on both the front and rear rolling wheels.

The other motor roller is a 2½-ton machine, which, although it is designed for footpath construction and maintenance, can be employed on light road work. The machine has a rolling width of 4ft., but when converted for grass rolling, rear rolling wheels giving a 6ft. rolling width are fitted. When so converted the machine can be equipped to haul a triple mower, so that both grass rolling and cutting are performed simultaneously. Motive power is supplied by a four-cylinder petrol engine developing 13½ H.P. at a governed speed of 1100 r.p.m. The gears, which are machine cut and totally enclosed, are designed to give two speeds forward and reverse—fast 4 m.p.h. and slow 2 m.p.h. A quick-release draw-bar which can be operated from the driver's seat is fitted. The rolling pressure per inch of width of the 2½-ton machine approximates to that of a 5-ton tandem roller.

In addition to the duties already mentioned, a driving pulley can be fitted, by means of which the engine power can be utilised to drive other machinery, such as grinding mills, corn and seed crushers, oil cake breakers, small stonebreakers, &c.

Dairy machinery formed another attractive feature of Messrs. Barford and Perkins' stand.

E. R. AND F. TURNER, LTD.

The machine on the stand of Messrs. Turner, of Ipswich, which is of most interest to agriculturists was a new grain drier which has been specially designed for the use of farmers. It is simple in construction and easily manipulated, and it follows on the lines of the machine which was used in the trial by the Oxford University Research Department, but has been improved in several directions. One improvement is in the cold air section, which has now been arranged so that a strong current of cold air can be blown through the wheat after it has passed through the hot air section, so as to assist the drying and put the grain into good condition for milling or storing. Another improvement is in the discharge orifice, which can be regulated to a nicety and gives a free delivery at any desired rate. We are informed that this machine was installed on a farm in Hampshire last year and is giving highly satisfactory results. Oats have been dried from 24 per cent. of moisture down to 18 per cent., and wheat from 21 per cent. down to 16 per cent. Several types of grinding mills were shown, including the Juggernaut mill, which is fitted with burr composition stones, running vertically at a speed of about 500 revolutions per minute, and which is intended for grinding all kinds of grain into fine meal, or, when fitted with special stones, for producing Sussex ground oats. The stand was driven by electric motors made by this firm, and sold by the associated firm, Bull Motors, Ltd. Some of the mills were direct coupled to electric motors.

BRITISH OXYGEN COMPANY.

A complete range of oxy-acetylene welding and cutting plant for the manufacture and repair of articles in any metal and for the demolition of scrap steel and ironwork was shown by the British Oxygen Company. A new feature was a combined truck and work bench on rubber-tired castor wheels, so arranged that the complete welding plant, comprising gas cylinders, blow-pipes, &c., can be taken to the work. Three or four oxygen cutting machines were shown in operation, including the portable straight line and circle cutting machine shown in Fig. 22, and a hole cutting machine. A number of interesting examples of welded repairs and articles of manufacture were also shown.

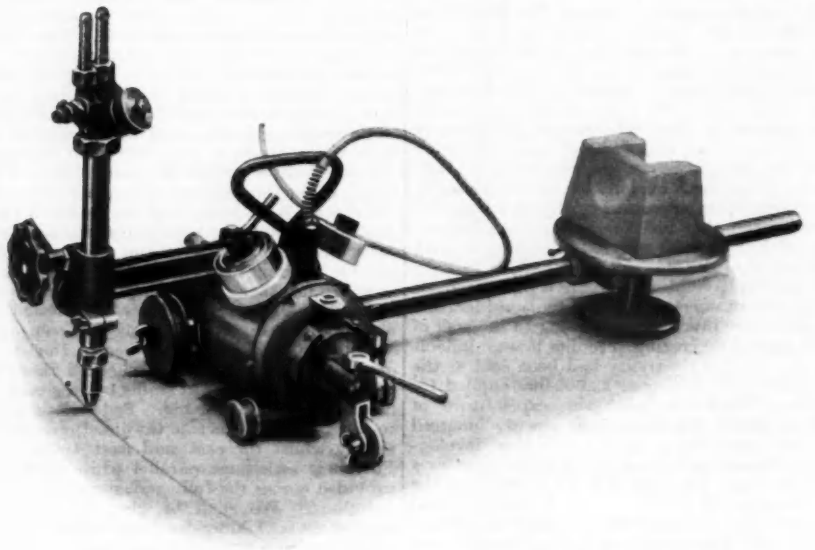


FIG. 22—PORTABLE STRAIGHT LINE AND CIRCLE CUTTING MACHINE—BRITISH OXYGEN

FAIRBANKS, MORSE AND CO.

The display of automatic water pumping plants made by this firm was, as usual, full of interest. With them, town's main conditions can be reproduced from ordinary deep or shallow wells, provided electric current is available. For shallow wells the motors employed have only a capacity of a fraction of a horse-power, so that the cost on that head is negligible. Amongst power pumps the self-oiling "typhoon" types are already familiar. They are of the high-speed pattern, running at 215 revolutions per minute. They are duplex double-acting, and the piston speeds are kept down to 75ft. per minute. This short-stroke, high-speed method of pumping is not usual in pumping practice, but after seven years of high-speed pumping with an increase in the number of reversals, the makers claim that they cut out the necessity for large air vessels and get an almost constant flow of water without visible pulsations. A totally-immersed drive is also obtained without the oil coming into contact with the water. It is also claimed that the wear is less than with long-stroke, slow-speed pumps. These pumps are intended for

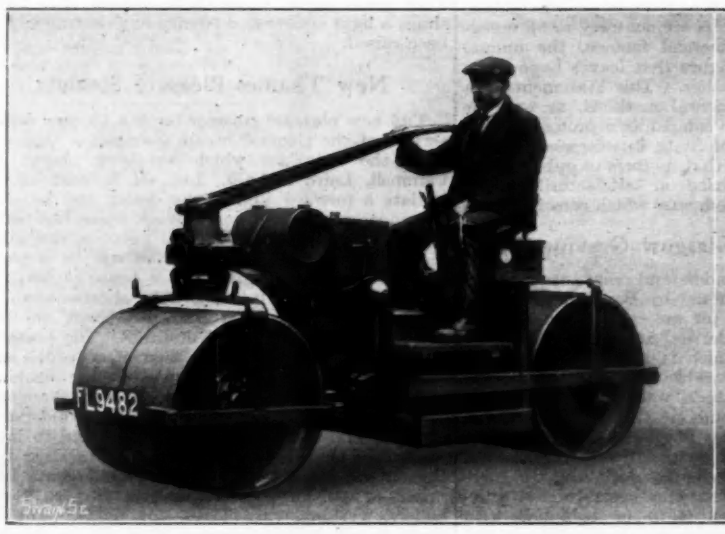


FIG. 20—LIGHT PETROL ROLLER—BARFORD AND PERKINS

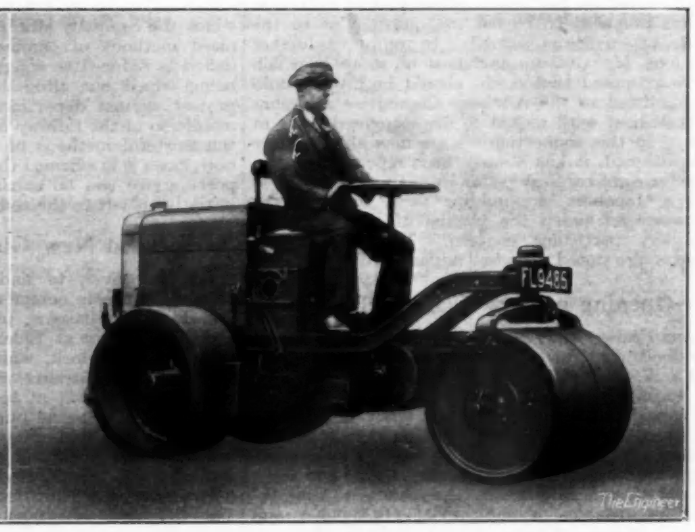


FIG. 21—2½-TON PETROL ROLLER—BARFORD AND PERKINS

* No. II. appeared July 10th.

all general work when the lift is not greater than 22ft. and the total discharge pressure does not exceed 100 lb. per square inch. They are of very pleasing design.

MASSEY-HARRIS.

One of the most original exhibits in the implement yard was the flexible four-wheel driven tractor made by the Massey-Harris Company, Ltd., of Bunhill-row, London, E.C. An illustration of this machine is given in Figs. 23 and 24 This company was one of the earliest to take up the manufacture of farm tractors. The machine illustrated has a vertical four-cylinder engine of the L head type and cylinders 4in. bore by 4½in. stroke, the normal speed being 1200 revolutions per minute. The engine is fitted with an oil air cleaner which can be readily removed when necessary for clearing out the accumulated dust, &c. The transmission is taken through the one-piece frame *vid* a gear box and differentials to two live axles on which the road wheels are secured, and the travelling speeds are 2·2, 3·2, and 4 miles per hour. The wheel base is 51in. and the driving wheels are 38in. diameter by 8in. face. There is a clearance of 30in. between the axles and the ground and the normal turning radius is 6½ft., which, by applying the brakes, can be reduced to 3ft. There is an extension shaft from the gear-box to the rear of the tractor for operating a harvester, and this shaft revolves at a speed of 545 revolutions per minute. The drive for the front wheels is fitted with universal joints which run in an oil bath, and the rear drive swivels so as to enable the driving wheels to accommodate themselves to uneven ground.

FIG. 23—FOUR-WHEEL-DRIVEN PETROL TRACTOR—MASSEY-HARRIS

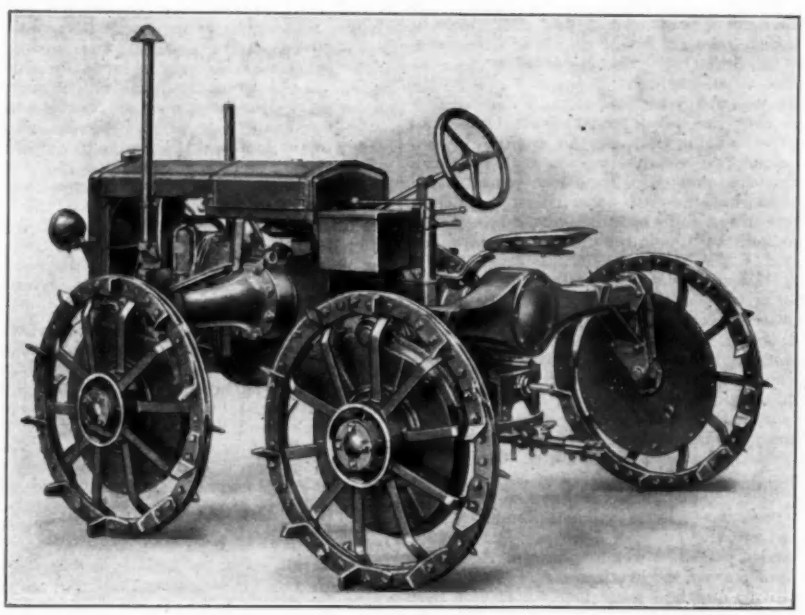


FIG. 24—FOUR-WHEEL-DRIVEN TRACTOR—MASSEY-HARRIS

J. AND H. MCLAREN.

The firm of J. and H. McLaren, of Leeds, has for some time taken a leading part in the application of the compression-ignition engine to agricultural implements, and its display at Warwick was even more representative than at previous Shows. The windlass used for ploughing and cultivating on the cable system is already familiar to readers of THE ENGINEER. The engine is of an improved super-charged high-speed type fitted with McLaren-Benz airless-injection mechanism. Another exhibit was a 30–35 B.H.P. tractor for ploughing, cultivating, transport, and belt driving, which is mounted on chain tracks and has three forward speeds and a reverse. The engine is of the two-cylinder four-cycle vertical type, giving 30 brake horse-power at 800 revolutions per minute. The cylinders are 135 mm. bore by 200 mm. stroke, and a centrifugal governor regulates the engine speed independently of the load from 250 revolutions per minute to 800 revolutions per minute. There are three forward road speeds of 2, 3, and 6½ miles per hour and one reverse speed of 3 miles per hour. A differential gear with locking device, as well as a belt pulley driven off the gear-box, are provided. The front axle is carried on semi-elliptical springs and the engine is encased by dustproof covers. This is a very stiffly built tractor weighing in working order 45 cwt. Messrs. McLaren also had on view a series of high-speed airless-injection engines varying in power from 90 B.H.P. to 6 B.H.P. A lighting set comprising a 10 B.H.P. engine coupled to a 5-kW electric generator complete with switchboard makes a very compact and economical lighting plant. One of the newest designs is a 50 B.H.P. four-cylinder engine of the four-stroke pattern running at 1500 revolutions per minute, and on similar lines this firm is now building a 75 B.H.P. engine with six cylinders and a single-cylinder engine designed for yacht propulsion. These engines are fitted with either hand or electric starting gear.

PULSOMETER ENGINEERING COMPANY.

The Pulsometer Engineering Company's, Ltd., exhibits consisted of small-size centrifugal pumps of various types, together with two Pulsometer steam pumps, one complete and the other in section, and two working models of ammonia-type refrigerating machines arranged for milk cooling and storage purposes. These were of the latest direct-expansion type and one was connected to a small ice cream freezing device. Both of these plants have been fully tested, and are, we are informed, being extensively adopted by farmers and dairymen.

(To be continued.)

Institution of Naval Architects.

No. III. *(conclusion).**

SUMMER MEETING IN PARIS.

WE continue below our account of the Paris Summer Meeting of the Institution of Naval Architects and the Association Technique Maritime et Aéronautique.

The second paper read on Thursday morning, July 2nd, was one on "The Effect of Modern Machinery on the Design of Large Ships," by Messrs. A. T. Wall and H. C. Cary, an abstract of which was given on page 46 of our issue of July 10th.

MODERN MACHINERY AND LARGE SHIPS.

The discussion was opened by the reading of a letter from Sir John Biles, which directed attention to two points of importance to the results. One was the greater output of steam per square foot of heating surface assumed for the Johnson over the Yarrow boiler, viz., 12 lb. against 7 lb. It seemed to be likely that most of the differences in results shown in the curves were due to the difference in steam output per square foot of heating surface. It would be interesting in that connection to know the actual weight of boilers assumed. The other point upon which there might be some difference of opinion was that of the maximum horse-power per shaft, though that question would have no effect on the relative results shown in the diagram, but only on the maximum possible horse-power, viz., 240,000, on trial. At the moment, that figure seemed to be beyond the requirements of existing shipowners, so that a decision on that question might be postponed. On one point, that of the horse-power for a 1000ft. ship, namely, 203,000 S.H.P., for 33 knots, he was gratified to find that his own estimate of 200,000 S.H.P. for a ship of the same dimensions and speed, as given in his paper on "Atlantic Ships," read in Glasgow in 1929, was not so far out. The results given by Mr. Wall were most interesting in form and substance. Some naval architects had had to work out many special cases, but Mr. Wall had given a general solution, which, while it could not fail to embody some special cases already dealt with, gave, for the first time, a general solution.

Engineer Rear-Admiral W. M. Whayman, speaking on the question of the rating of boilers, said that there had been experience for some time with water-tube boilers steaming at 9 lb. per square foot of heating surface in marine service, and in H.M. Navy, and he himself had quoted some relevant figures in the discussion on the paper by Mr. Yarrow at the spring meeting. As a matter of fact, rates of steaming had been achieved in the Navy many years ago of the same order or even higher than those now given by the authors for the Johnson boiler. In the case of the battle-cruiser "Hood," which was completed towards the end of the war, the rate of steaming was at least as high, if not higher, than the figures quoted by the authors for the express type of boiler. Therefore engineers need not anticipate any difficulty in maintaining the rates which the authors suggested should be adopted for the higher power ship in the future. His own opinion was that a well-designed water-tube boiler would give that output equally with any other type.

Mr. W. Nithsdale (Messrs. Yarrow) said a feature of the paper was the predominant influence of boiler plant; indeed, the title might well be "The Effect of Boilers on the Design of Large Ships." Of the three types dealt with, the arguments for A and B—Table I.—were well substantiated—A representing good modern cylindrical boiler practice, while B embraced proved designs of water-tube boiler at ratings little in excess of those for Scotch boilers—but the figures for C were more conjectural and open to comment. Anyone who had studied the history and patents of boilers must have been impressed by the fact that almost every conceivable combination of drums and tubes had been thought of at one time or another during the last century. For instance, if reference was made to the interesting book by the illustrious Monsieur Paul Augustin Normand entitled "Les Origines des Chaudières" (1825–1885), there would be observed, on pages 43 and 46, a water-tube boiler invented by Craddock in 1857 which was very similar to the Johnson boiler, and in the paper read by Mr. F. J. Rowan before the Institution of Engineers and Shipbuilders in Scotland (1897), another somewhat similar type by Seabury—Fig. 47—appeared. Superheater tubes expanded direct into a saturated steam drum were also of comparatively old design—see Yarrow Patent 10,231, dated 1910. The authors really compared actual practical results of one water-tube boiler at very conservative ratings with those of a type at much higher ratings, in spite of the fact that the latter type was practically untried at any rating. On the "Princess Helene," which has two Yarrow boilers and one Johnson, all with the same amount of generating surface, the efficiencies of the Yarrow and Johnson boilers themselves did not differ sensibly over a wide range of exhaustive tests up to 11·5 lb. rating. As would be expected, a much larger air heater fitted to the Johnson type gave rise to somewhat improved combined efficiency, while the Johnson boiler alone, having less water content, was rather lighter. Overall efficiency depended on the

* No. II. appeared July 10th.

total surface of an installation. If the boiler was small and worked at a high rate, a large air heater was necessary to absorb the heat of the gases for good efficiency. On the other hand, if the boiler was large and worked at a low rate the gas temperature was reduced by the boiler surface itself and only a small air heater would suffice for good efficiency. The same principle held, of course, for any boiler. His remarks, however, did not affect the main issue of the paper as between cylindrical and water-tube boilers, but only the implied distinction between types B and C.

Monsieur Rolland Boris, Ingénieur Général de Génie Maritime, said that the cost of high speed, dealt with in the paper, reminded him of the letter of the chairman of the Cunard Company to his shareholders, in which he explained what the future Cunarders should be. The effect of saving a day in the case of liners was quite a different matter from that of saving time in the case of cargo vessels. It was interesting to notice the development that had taken place in the speed of Atlantic liners over a period of years. In 1890 a journey took eight days with vessels 450ft. long, fitted with machinery of 8000 H.P., and the speed was about 16 knots. By 1900 the journey was done in six days, with vessels of from 650ft. to 700ft., having machinery of 30,000 H.P., the speed being 21 knots. At the present time the passage took about five days with vessels of 800ft. and 100,000 H.P., the speed being 26 knots in the case of the "Bremen" and the "Europa." In addition to these speeds, however, there should be a margin to take account of weather conditions, and if the journey to New York was to be done, as some people would like, in, say, four days, it would probably mean vessels of 1300ft. or 1400ft., fitted with 200,000 to 250,000 H.P., and it would be necessary to have a speed of 32 knots to 35 knots in order to leave a definite margin for weather conditions. The paper referred to "the most economical ship," and if there had been time he would have liked to ask the author exactly what was the most economical ship. It was a very wide subject, involving questions relating to harbours and docks. Economy could hardly be considered from one point of view only, and it certainly involved much more than the vessel itself.

Mr. J. Hamilton Gibson said the statement made by the authors in relation to stability, that no account had been taken by them of the effect of modern machinery with its lighter weight and reduced fuel consumption, as governing hull proportions, seemed to be opposed to the title and spirit of the paper. If, however, the authors were referring to ultra-modern or future machinery, it became more understandable, although even then it was difficult to see that the results would be inappreciable. A figure of from 12 to 22 S.H.P. per ton was quoted in that connection for marine water-tube boilers. For the "Bremen" that figure had been given as 16·1 on 100,000 S.H.P., but as that vessel was credited with 130,000 S.H.P., it might be as high as 21. Personally, however, he felt strongly that marine machinery would in the immediate future show up even better than that, and at least 30 S.H.P. per ton was not too much to expect for high-class merchant ships. Twenty-five years ago a figure of 52·5 S.H.P. per ton was obtained on H.M.S. "Swift," a 36-knot destroyer of 2000 tons displacement and 48,000 H.P. The battle-cruiser "Hood" of twelve years ago did 28 S.H.P. per ton, based on her 150,000 H.P., and H.M. battleships "Nelson" and "Rodney" attained a figure of 24 S.H.P. per ton three years go. The propelling machinery of the Washington plan cruisers was designed on a basis of 50. If best materials were used weights could be considerably reduced without incurring additional risk. Moreover, there were elements in modern design which made for lightness, quite apart from the question of material. Boiler units were growing larger and consequently fewer for a given total H.P., and there was no need to be content with a modest 5 lb. to 5½ lb. of steam per square foot of heating surface per hour, when, according to Mr. Harold Yarrow's recent Institution paper, an evaporation of 16¾ lb. to 17½ lb. represented naval practice, and even a Scotch boiler might be rated at 6 lb. Land boiler practice had gone far ahead in recent years, the outstanding features being working pressures up to 1400 lb. per square inch—600 lb. was now quite a common land pressure—and complete water-walling of the furnace. For some time to come marine practice was not likely to exceed 500 lb. or 600 lb., beyond which reheating, with its attendant complications, would be necessary. With the means now used to control instantly and automatically the degree of superheat during manœuvring, a steady 800 deg. or 825 deg. Fah. would be available, ensuring dry steam almost down to condenser pressure. The Johnson boiler followed land practice, in that its furnace was completely water-walled, as steam generating tubes formed the floor and ends as well as the roof and sides of the combustion chamber. For that reason he would have no hesitation in adopting a higher rating than the figure of 12 quoted by the authors. A 50 per cent. increase was well within the limitations of that boiler, and without undue forcing. On the score of space, within the last four or five years, boiler-room areas had been halved. For example, the new "Empress of Britain's" boiler-rooms would be twice the size they are if based on the C.P.S. "Duchess" class practice. It was difficult to predict what would happen with regard to turbine machinery in the direction of reducing weight and space. That problem was tied up with that of the propeller. The late Sir Henry Segrave's wonderful performance in driving the propeller of "Miss England II." at over 12,000 r.p.m. had made some engineers wonder whether there might not be a reversion to the direct drive turbine. Incidentally, it might be remarked that a noted French company had always remained faithful to the direct drive in big fast liners. If smaller direct-driven propellers were admitted, why be limited to four lines of shafting at approximately the same draught. Why not six or eight at different levels? Apart, however, from revolutionary proposals, we might with impunity go to 30 S.H.P. per ton for high-class, high-speed, high-powered marine machinery. What would that mean? According to Table IV. of the paper, about 100,000 S.H.P. was required for a 29-knot vessel carrying only 2000 tons deadweight. Assuming 20 S.H.P. per ton, the machinery weighed 5000 tons, but 30 S.H.P. per ton would reduce that by 1667 tons. That, however, was not all. Very shortly we should see oil fuel consumption reduced to 0·5 lb. per S.H.P. per hour for all purposes. There was a good 10 per cent. to be picked up from the funnel gases alone by a reversion to economisers, and several people, including Mr. Johnson, were working in that direction. Compared with the 0·575 lb., which was about the average taken by the authors, that would mean a saving of 80 tons per day or 800 tons for ten days' steaming. The total saving on machinery, plus fuel, would thus more than double the deadweight capacity of that particular vessel, or, alternatively, upset all the calculations and proportions that the authors had so carefully worked out. In other words, a smaller and lighter vessel with less horse-power would suffice.

Sir Eustace Tennyson d'Eyncourt said the paper was a most valuable contribution to the whole question of design of big ships, but the statement made towards the end of it, namely, "the results obtained in this paper should not be applied to any particular ship without careful consideration," was very important indeed. Admiral Whayman had referred to the "Hood," and he himself could go a little farther, and say that the figures taken by the authors were really improved upon by the actual performance of the "Hood," which was designed at the Admiralty when he himself was there fifteen years ago. In the trials, not in smooth water but in ordinary weather, a speed of just over 32 knots was obtained with 150,000 H.P., and a displacement of over 44,000 tons. That was the only ship of large size which had attained a speed of over 30 knots, and the actual figures were worth consideration in connection with the points made in the paper. As regarded transmission, he considered mechanical transmission at the present stage as much better than electrical transmission—of which a great deal had been heard lately—because there were not nearly the losses in mechanical transmission that there were in electrical transmission, although no doubt there were advantages in the latter. The paper gave the final *coup de grace* to the cylindrical boiler for very big powers. He was not quite sure that he agreed with the authors that the development of the boiler had proceeded faster than that of the engines. Engineers had developed machinery with high pressures and temperatures, and that, to a great extent, had made the boilermakers push on with more efficient boilers. It would perhaps be more correct to say that the boilermakers and engine makers had gone along hand in hand.

Monsieur F. Ziegel asked the authors for a further explanation of the curves in Fig. 19 of the paper. The HP curves between 900ft. and 1000ft. and between 500ft. and 600ft. were nearly horizontal and from that it appeared that a ship with the same block coefficient and with the same speed could be built either with a length of 900ft. and a displacement of 57,000 tons, or 1000ft. and a displacement of 73,000 tons, without any important increase in the H.P. On the question of boilers he asked if the Johnson boiler demanded as little maintenance as the boilers previously used. That fact would have an important bearing in the case of large Atlantic liners. At the present moment the exact weight per H.P. which could be carried per shaft was not known. According to the authors' curves, the maximum was 60,000 H.P., but hitherto no one had gone beyond 40,000 H.P. per shaft. To increase that figure by 50 per cent. might introduce many new problems, for which special arrangements would have to be made. The question of cost of transport of a passenger was also an important matter to be considered. At the present time, no one knew how much it cost to transport a passenger to America, because the actual cost was masked by Government subsidies. Therefore, some real comparison of figures of costs would be valuable. The enormous increase in speed of transport necessarily increased the cost and some figures in that connection would be welcome.

Mr. Wall, briefly replying to the discussion, said that some of the points raised would have to be answered in writing.

Development of Marine Internal Combustion Engines.

The final paper of the meeting was one "On the Development of Marine Internal Combustion Engines," by Monsieur Paul Dumanois.

The author confined himself to the discussion of two main tendencies—airless injection and supercharging—which, he said, appeared to lead both to a simplification and an increase in power. The air injection and the airless-injection principles were contrasted, and the use of ante-combustion chambers and their design discussed. Although it could not now be said that air compressors gave rise to a large number of breakdowns, they might, like other machines, get out of order. The question of sudden pressure rises in the high-pressure cylinders, caused by the combustion of lubricating oil, was an important one, upon which valuable experimental work had been done by Messrs. Mondain-Monval and Quanquin, the results of which were referred to in the paper.

Late years had seen the solution of the problem of airless injection for cylinders up to 200 B.H.P., and present-day tests seemed to indicate further progress in that direction.

A characteristic feature was the increase in the power of units. Engines of 8000 H.P. were no longer the exception, and some builders even contemplated the construction of 30,000 H.P. units. Outputs of 1000 H.P. per cylinder were now greatly exceeded in actual practice, one maker having tested an engine of the two-stroke, single-cylinder, double-acting type, designed to develop 3400 I.H.P. The cylinder was 41·33in. diameter and the stroke 74·8in.

The increasing demand for power had led to an agreement in favour of the two-stroke, double-acting engine. In all such engines, especially marine engines, supercharging would play a greatly increased part. After discussing supercharging in its theoretical and practical aspects, the author went on to show that if the power developed by an ordinary four-stroke cylinder be taken as unity, then the four-stroke single-acting cylinder provided with a supercharger would develop 1·6; the two-stroke, single-acting cylinder with fuel supply at the usual pressure of the scavenging pumps, 1·8; the four-stroke, double-acting ordinary cylinder, 1·85; the four-stroke, double-acting cylinder with supercharger, 3·0; the two-stroke, double-acting cylinder, with fuel supply by the scavenging pumps, 3·3 times the unit power. Finally, the two-stroke, double-acting cylinder, working with supercharge under the same conditions would enable a figure of 4·4 to be attained. In other words, for the same cylinder dimensions the same space taken up in length, and at the cost of an increase in weight of the order of only 17·6 lb. per horse-power, the provision of supercharging would allow an increase in power of over 30 per cent., as compared with the ordinary two-stroke, double-acting cylinder. Those considerations, although theoretical, were, the author stated, based on results obtained from the actual running of exhaust turbo-compressor sets. The high outlet temperature of the exhaust gases, say, 700 deg. Cent., would have to be taken into account, but experience with turbo-blowers working in conjunction with aviation engines had shown that the problem was not an insoluble one. Quite apart from other considerations, the two-stroke, double-acting, supercharged engine had a noteworthy advantage over the two-stroke, double-acting, ordinary engine in thermal efficiency, by reason of the increase in effective power and the non-appropriation of power from the ship for driving the scavenge pump. The only difference from the consumption point of view, compared with the four-stroke supercharged engine, proceeded solely from the difference in thermal efficiency arising from the opening of the scavenging ports for a shorter fraction of the expansion stroke than with the case of the four-stroke engine.

Mr. A. C. Hardy, opening the discussion, said that the question of airless injection and supercharging in connection with Diesel engines for ships was one of the most important problems at the moment. Indeed, it could be said that the development in that particular branch during the last four years had put the four-cycle engine in a place where it was now largely out of danger of any eclipse by the two-cycle engine. The two-cycle engine had developed very much in the last few years, and particularly in its airless injection double-acting form, and it was a very attractive suggestion for the engineering of certain ships, but with supercharging and airless injection the four-cycle engine was now, perhaps, the most perfect form of powering for certain types of ships. There remained, however, the question of how best the supercharging and airless-injection effect was to be carried out. The paper was mainly concerned with the exhaust gas system, which had proved so successful in practice, both with the Rateau blower and the Büchi blower. A few months ago, M. Lugt, chief engineer and designer to the Werkspoor Company, read a paper before the Institution of Engineers and Shipbuilders in Scotland, in which he dealt with that company's particular form of supercharging, which was effected by closing in the bottom of the cylinder, and it was, to a certain extent, remarkable that some of the conclusions arrived at in that paper were similar to those of the present author. He was not, however, referring to technical, but to economic conclusions, because it must now be agreed that supercharging and airless injection had reached a stage when it was as much an economic as a technical matter. The supercharger could be compared with exhaust turbine arrangements, inasmuch as the theoretical

ideal was that something was being obtained for nothing, because the power of the engine was being increased without increasing its size. That had a tremendous effect, for example, on the speed of tankers. The Anglo-Saxon Company had superchargers on all its new fleet of 20 tankers, and had thereby made it possible to run those ships at a service speed of about 13 knots.

Monsieur Georges Lehr said that many engineers held the view that the chief objection to the extension of the use of the two-stroke engine lay in the waste of fuel not burned and discharged with the exhaust gases. That drawback, however, disappeared when the scavenging was done with pure air, and, in that event, the two-stroke engine should become more popular. The reason for the want of success of the two-stroke engine, however, was that it was not able to work satisfactorily at as high a speed as the four-stroke engine, and all the manufacturers of two-stroke engines recognised the force of that contention. For that reason, as long as pure scavenging air was practicable with airless injection, it would not pay to adopt two-stroke working.

The author was unable to reply owing to lack of time.

The Chairman, proposing a vote of thanks to the author, referred to the late Professor Rateau, the inventor of the supercharging turbo-compressor, and expressed his gratification at the value of the papers presented at the meeting, which, together with the discussions upon them, would, he said, form outstanding contributions to the "Transactions" of the two Institutions. In conclusion, he expressed his personal thanks for the opportunity that had been accorded him of presiding at the second session of the meeting.

The President, speaking on behalf of the Institution of Naval Architects, said the Paris Meeting of 1931 would for ever hold a memorable place in the records of the Institution for more than one reason. In the first place, it had been productive of papers of unusual brilliancy and interest, papers which had gone beyond the technique of the matter and had broadened the interest for the whole world. The second reason why the meeting would be memorable was the manner in which those who had come from Great Britain had been received in Paris by their French colleagues. Monsieur Rousseau and his *confrères* he specially thanked for the most cordial welcome they had given to the English party, and at the same time everybody was extremely grateful to Monsieur Georges Bourgès, the Secretary of the Association Technique Maritime et Aeronautique, and Mr. R. W. Dana, the Secretary of the Institution of Naval Architects, for the arrangements they had made for the meeting and visit.

The meeting then closed.

The Institution Banquet.

A banquet was given by the Institution at the Hotel Continental, Paris, on Wednesday evening, July 1st, to which a large number of members of the Association Technique Maritime et Aéronautique and others acting as hosts were invited. Admiral of the Fleet Lord Wester Wemyss was in the chair.

After the toast of "The President of the French Republic" that of "His Majesty the King" was duly honoured.

The Chairman, in proposing the toast of "L'Association Technique Maritime et Aéronautique," with which he coupled the name of Monsieur Emmanuel Rousseau, President, and Conseiller d'Etat, said it was a pleasing reflection that British naval architects were so closely allied with that famous Association. The members of both bodies had common aims, and their work was conducted on the same principles and along the same lines, and it was hoped that both together would do a great deal of good for the world in general. It was the object of both the British Institution and the French Association to assist in improvements in science and the search after knowledge. There were also links between the two organisations which, whilst not being technical, were of even greater value, and those were the links of friendship. The Institution of Naval Architects had been greatly honoured by being received by the President of the French Republic, and it had also been honoured by the presence during the meetings of the Minister of Marine, the Minister for Air, the Minister of the Mercantile Marine, and also the Minister of the Colonies, and the thanks of the British visitors were offered to them all for their interest in the work of the Institution and for making the meeting the success it had been. It was a happy incident, continued the President, that this summer meeting had coincided with the holding of the wonderful Colonial Exhibition, to which a visit had been paid that day. The visitors had nothing but admiration for the energy, organisation and knowledge that had been put into it. He congratulated Maréchal Lyautey and all connected with the Exhibition, which was outstanding proof of what France had done for the civilisation of the world. Everybody hoped that the Exhibition would be an outstanding success.

Monsieur Emmanuel Rousseau (President of the French Association) responded to the toast, and at the same time proposed the toast of "The Institution of Naval Architects." The Institution, he said, had always been prominent on the practical side of naval architecture and had not been content to devote itself to theory only. It was for that reason that the French Association had derived so much help from the work of the British Institution. Commenting on the decision of the French Association not to limit its activities to maritime problems, but to take in also the science of aviation, Monsieur Rousseau said that the results had fully justified that step, for there was an important link between transport by sea and transport by air.

Monsieur de Chappedelaine, Ministre de la Marine Marchande, in the course of a speech in which he touched upon a number of matters, said that the Institution of Naval Architects, which had passed its seventieth anniversary, had the advantage in that respect over the French Association, and French naval architects and constructors were grateful for the sympathetic attitude which had always been shown towards them by British naval constructors ever since the French Association came into existence eighteen years after the foundation of the British Institution. The French Association, however, was the first organisation of its kind on the Continent of Europe. At the present moment our two countries, he continued, were going through a crisis, the outcome of which was difficult to forecast. The construction of such a large number of ships during the past few years had had the effect of lowering frieghts to an uneconomic level, whilst trade conditions had resulted in fewer orders for ships being given, and at the moment there seemed a danger of man being destroyed by the very machines that he had created for the welfare of mankind. Was the British nation, he asked, which constructed half the number of ships built in the world, going to be submerged by the very magnitude of that work? He did not believe that would be so. Many ships now in service were old and must soon disappear and be replaced by new construction when industrial conditions improved. In conclusion, Monsieur Chappedelaine expressed his satisfaction that the British Institution of Naval Architects had held its meeting in France again this year, because he saw in that fact a means for forming a still closer alliance between Great Britain and France.

The toast of "The Ladies" was proposed in felicitous terms by Sir Archibald Denny, who spoke in French and English alternately. Special mention was made by Sir Archibald of the excellent work which had been done by Madame Rousseau and Madame Bourgès in making the ladies of the party welcome.

SOCIAL ENGAGEMENTS AND VISITS.

As recorded in our issue of July 3rd, the members of the British and French parties first met each other at an informal reception, which took place at the Hotel Georges V. on Monday evening, June 29th. Throughout the week there were many social engagements and visits, which gave members an opportunity of meeting each other and of discussing matters of mutual national interest.

The afternoon of June 30th was set apart for a visit to the Hôtel des Invalides, and the evening of that day to an official reception in honour of the Institution of Naval Architects by the Minister of Marine, in the Admiralty Buildings on the Place de la Concorde.

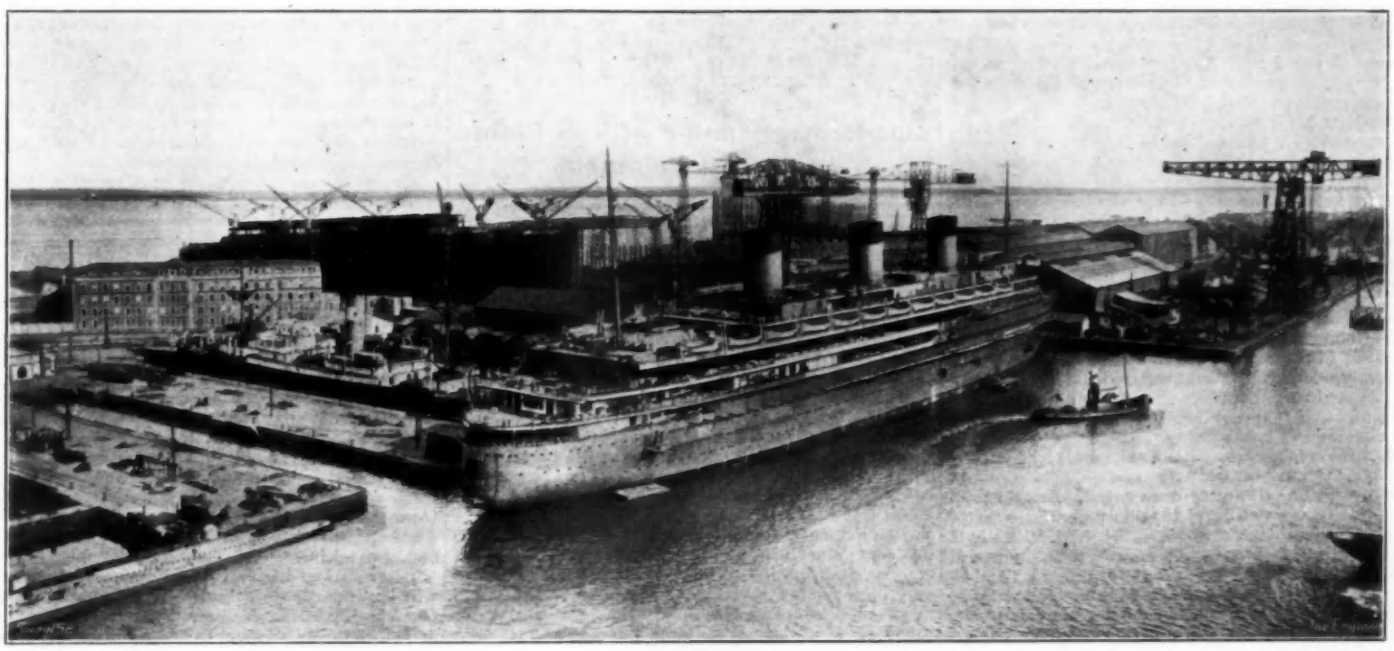
The whole of Wednesday morning, July 1st, was given up to a visit to the International Colonial Exhibition in the Bois de Vincennes. At a luncheon served in the Restaurant Bagdad, on the Isle of Bercy, Lake Daumesnil, the party was welcomed by Monsieur Paul Reynaud, Minister of the Colonies, to whose speech Lord Wester Wemyss fittingly replied.

During the afternoon of the same day members of the party visited the Paris Chamber of Commerce in the Avenue Friedland, where they were received and shown over the house and the gardens by Monsieur Baudet, the President of the Chamber of Commerce, members of the Chamber and the staff.

After the luncheon interval, following the reading of papers on Thursday morning, special cars left the Place de la Concorde for the aerodrome of Le Bourget. The party was received by Monsieur Charles Lefebre, Director of the Bureau Veritas, and visitors were shown over the aerodrome, several taking the opportunity afforded of making short flights.

The Loire Chateau Country.

Early on the morning of Friday, July 3rd, the whole party left the Gare d'Orsay by special train for Blois, Tours and La Baule. On arrival at Blois motor cars were waiting and the famous Château de Blois was visited. The visitors were met by Dr. le Sueur, the Conservateur du Château de Blois, and the Mayor of Blois, who showed the party over the historic castle. The famous Renaissance architecture was much admired. Luncheon was served in the Château in the Room of the State Generals. Early in the afternoon the party again left by motor cars for Tours, passing along the Loire and viewing in the distance the Châteaux of



THE SHIPYARD OF LA SOCIETE ANONYME DES CHANTIER ET ATELIERS DE ST. NAZAIRE PENHOËT

Chaumont and Amboise. At the Château of Chenonceaux, which is built on arches over the river Cher, the owner of the castle, Senator Gaston Menier, met the members and personally conducted them over the rooms, which have been retained in harmony with their rich historic past. Tea was offered by Monsieur Gaston in the long hall on the lower floor, and the visit was a memorable end to a day full of interest. A brief halt was made to inspect the cathedral at Tours, after which the train was rejoined and the journey continued to Nantes and La Baule. Passing through Nantes the party was welcomed by special illuminations on the hull of a destroyer on the stocks of the shipyard, which formed the initials A.T.M.A. and I.N.A. and a greeting.

Visits to Shipyards and Engine Works.

The stay at the charming seaside resort of La Baule was all too short, and early next morning cars left the hotel, and proceeded to St. Nazaire, where the port and the shipyards of La Société Anonyme des Chantier et Ateliers de St. Nazaire Penhoët were inspected. A view of the yard is reproduced on page 59. There are five building slips, the largest of which has a length of 1020ft. and can be later extended to 1150ft. Considerable interest was shown in this new slip, which had on it the 70,000 gross ton super liner "Ile de France," which will be electrically propelled, and is being constructed to the order of the Compagnie Générale Transatlantique. Another interesting liner which was approaching completion was the Compagnie Sud Atlantique's new 722ft. turbine-driven liner "L'Atlantique," which is shown in the foreground of our engraving. Both as regards her decoration and her propelling machinery this vessel is of great interest, but, owing to the state of work on board, it was, unfortunately, not possible to inspect her fully. Another vessel on the stocks was the 28,000-ton turbine-driven liner "Champlain," an enlarged type of the "Lafayette" class, for the Havre-New York service of the Compagnie Générale Transatlantique. Considerable interest was shown in the well-designed crane equipment of the slipways and storage yards, and the construction of coffer-dams for keeping the water from the launching ways. The party had the advantage of being personally conducted over the yard by the President, Monsieur René Fould, and Monsieur F. Coqueret, one of the managing directors, along with engineers of the staff.

Luncheon was served in the large works canteen. In the course of his welcoming speech, which was delivered in a forceful style by the President of the Company, Monsieur Fould referred to the close connection existing between the British and French Societies and expressed his pleasure in showing the visitors what was being done at the Penhoët yards. He contrasted the mail steamer "Impératrice Eugénie," launched in 1864 at Penhoët, a vessel of 106·5 m. length and 9·6 m. beam, with a horse-power of 2600, with "L'Atlantique," the latest liner, shortly to be delivered, which had a length of 224 m., a beam of 20·5 m., and turbine engines of 60,000 S.H.P. These figures served, he said, to illustrate the enormous advance which had been made in shipbuilding and marine engineering practice. The improvement in comfort and decoration had been equally startling.

In the face of the present world-wide shipbuilding depression it was necessary, he thought, to study deeply the economic position, and suggest some means of controlling the output of ships in such a manner as would bring revived prosperity to the industry. That was a task in which French and British naval architects and engineers could collaborate, and if it was undertaken with British initiative he had no fear of the results.

In reply to Monsieur Fould, Admiral of the Fleet Lord Wester Wemyss expressed thanks on behalf of the Institution of Naval Architects for the kindness that had been shown to the visitors that day and the trouble that had been taken in showing them over the works. There was, he said, ample evidence there of the manner in which French shipbuilders had overcome difficulties. That, he was sorry to say, was the last occasion on which they would all meet together, and he must take advantage of it to say how very pleased everybody had been with the visit. The object of the Institution and the Association was to work for the benefit of mankind, because the good of mankind was closely associated with the facility of transportation. The *entente* between the two societies, he honestly believed, had been strengthened by the visit, and it was only typical of the *entente* that existed between the two great Western nations as a whole. The English character and the French character differed in detail, but when it came to great things, as was proved fourteen years ago, there was no resisting them. He again thanked the company and especially its President, Monsieur René Fould, for what it had done that day. Monsieur E. Rousseau also paid a tribute to the enterprise of the Penhoët firm and expressed thanks on behalf of the French Association for the courtesy and kindness shown to the members during the visit to St. Nazaire.

After luncheon the party proceeded to the shipyards and engine works of La Société des Ateliers et Chantiers de la Loire, where they were received by Monsieur Petitjean, one of the directors, and his staff. Several large installations of turbines and gearing going through the shops were inspected, and the aeroplane shops were visited. Tea was served in the works, and at this last gathering Mr. R. W. Dana said that he would like to be allowed to say a word before the conclusion of these memorable meetings to express the heartfelt thanks of the Institution to those admirable French hosts for their courtesy, their hospitality, and the warm welcome they had extended to members during the stay in France. To the Association Technique Maritime, which had organised the visit, a debt of deep gratitude was owed. It was not for him to speak of the high qualities of their Association's distinguished President, Monsieur Rousseau, of whom Lord Wester Wemyss had already spoken so eloquently, but he would like to express warm thanks to Monsieur Bourgès, the General Secretary of the Association, who had carried out so admirably the details of the organisation. If genius was the capacity for taking infinite pains, Monsieur Bourgès had certainly shown that he possessed that gift, for without it the arrangements could never have gone through so smoothly and pleasantly.

Monsieur Bourgès, in his reply, expressed the great pleasure with which his Association had had in being able to arrange the meetings to be held in Paris, and the subsequent visits to the Loire and Saint Nazaire. He paid a tribute to the Institution of Naval Architects, the senior of all the societies in that branch of engineering, for its work in advancing the progress of naval architecture. The joint meeting of the members of the two societies had been a most happy one, and the French members had felt greatly honoured by the presence of so many distinguished naval architects from overseas.

This visit concluded the meetings of the Institution.

Zinc Recovery and Fertiliser Plants in British Columbia.

Two new units were recently put into operation by the Consolidated Mining and Smelting Company of Canada, at Trail, British Columbia. These units are a slag re-treatment plant, for the recovery of zinc hitherto lost, and a zinc oxide leaching plant for the treatment of the zinc recovered by the first plant. The savings to be effected through these two new units may be briefly summarised as follows.

In the first place, the plant will save daily 100 tons of zinc which have hitherto been lost. Secondly it is necessary to cool the hot gases and oxide coming from the furnace so that they may be handled, and in doing that in the waste heat boilers, steam is generated for wide distribution over the plant. The third saving is in the further cooling of the gas and oxide by passing them through an economiser, which heats the water used to make steam. Methods of smelting hitherto used caused a loss of about 15 per cent. zinc in slag from the lead blast-furnaces. A great deal of this slag has been saved in slag dumps and piles of tadanac. This slag and tadanac will eventually be passed through the new plants for recovery of the zinc content, but for the present most of the slag will come directly from the lead blast-furnaces. The loss of zinc in slag from the retreating furnaces will be very small. The waste slag will contain about 40 per cent. iron, but that metal will not be stored or saved for the present.

The design of the new slag re-treatment plant embodies several new principles. The process is as follows:—When the crude ore has been roasted and reduced to the stage of entering the blast-furnace, it consists chiefly of lead, zinc, iron and waste. The lead is drawn off as lead bullion in the blast-furnace and transported to the lead refinery. The remaining slag contains the zinc to be saved and the less valuable iron and other matter for which the company at present has no use. Slag from the lead blast-furnaces is carried by an overhead travelling crane, in 9-ton pots, to the mouth of the slag furnace. Forty tons of it are dumped into the furnace for each charge. The molten metal, boiling with its own heat, is flayed to greater activity as finely powdered coal driven by compressed air serving as a "feeder," is forced into the bottom of the furnace. Two great inverted cones of powdered coal stand on each side of the furnace with their accompanying compressed air equipment.

The intense heat of the slag as it comes from the blast-furnaces causes the zinc oxide compound in it to be reduced to metallic zinc by the carbon. This zinc then volatilises and turns back to zinc oxide in a free state. At the top of the slag furnaces emerge the zinc oxide in a fine dust, carbon dioxide, and some impurities which are removed by leaching.

The first step in the cooling process is the passage of the zinc oxide and gases through the waste heat boilers, where circulation among the water tubes produces steam. This steam is piped to various parts of the plant for heating purposes. The oxide and gases, still hot, then go through an economiser, preheating the water which the waste heat boilers convert into steam. The oxide is then cool enough for ordinary purposes, and it is started through the flues. Everywhere that the dust is likely to fall, hoppers are provided for its collection.

Forced along by fans, the gas carrying the oxide enters the bag house. There there are inverted cones which each contain a number of finely-woven woollen bags. The gas passes through these bags, but the solid material remains inside. At regular intervals, the flow of gas and oxide is stopped while an automatic device shakes the dust from the bags to screw conveyors, which carry it to a 40-ton bin, where it is loaded into specially prepared railway hopper cars for transportation to the new 500,000-dollar leaching plant.

This plant, built expressly to handle the product of the slag re-treatment plant, provides a special leaching process. In principle it is similar to the ordinary process, but a more extensive purification is required before the solutions reach the tank rooms for electrolysis. There are two steps in the purification process—first, a roughing-out of some of the impurities with atomised zinc, and secondly, the final removal of the more elusive impurities in heated solutions by chemical action. The purified solution—zinc sulphate and water—is delivered by centrifugal pump to the electrolytic tank rooms. As in the other leaching plant, cadmium is a by-product of this process. The company produces more than one-third of the world's supply of cadmium.

In the slag re-treatment plant, one furnace and two waste heat boilers are at present in use, but provision has been made for the installation of another furnace and boiler when an increase in the daily quantity of ore treated makes this step necessary. Views of these plants are given herewith and on page 68.

New Fertiliser Plant.

Interest centres in the 10,000,000-dollar fertiliser plant which the company is erecting on a 137-acre site known as the Warfield flat at Tadanac, on the outskirts of Trail. This enormous new industry, which is being laid out as a first unit in still larger plans, is to be in partial operation next spring, at least, so far as the superphosphate plant is concerned. It will be some time later before the other major fertiliser products, such as ammonium sulphate and ammonium phosphate, are turned out.

The whole layout consists of a group of administrative buildings, battery of shops and manufacturing units, all being laid out with a view to further expansion, the final units to overlook the great Tadanac metallurgical works of Consolidated Smelters on the ground below the Warfield flat.

Passing over the workmen's "change" house and the auxiliary buildings, such as stores, carpenter shop and machine shop, already built and at work, and coming to the actual manufacturing units, the various plants comprised in the left half of the manufacturing area may be alluded to in a single group as the ammonia plant. They are the hydrogen plant, on the outer end of which is the mercury arc rectifier installation, a central plant called in brief the nitrogen plant, then the ammonia plant. Next spring an ammonium sulphate plant of 150 tons daily capacity will be built to utilise the ammonia which is needed in production of this type of chemical fertiliser.

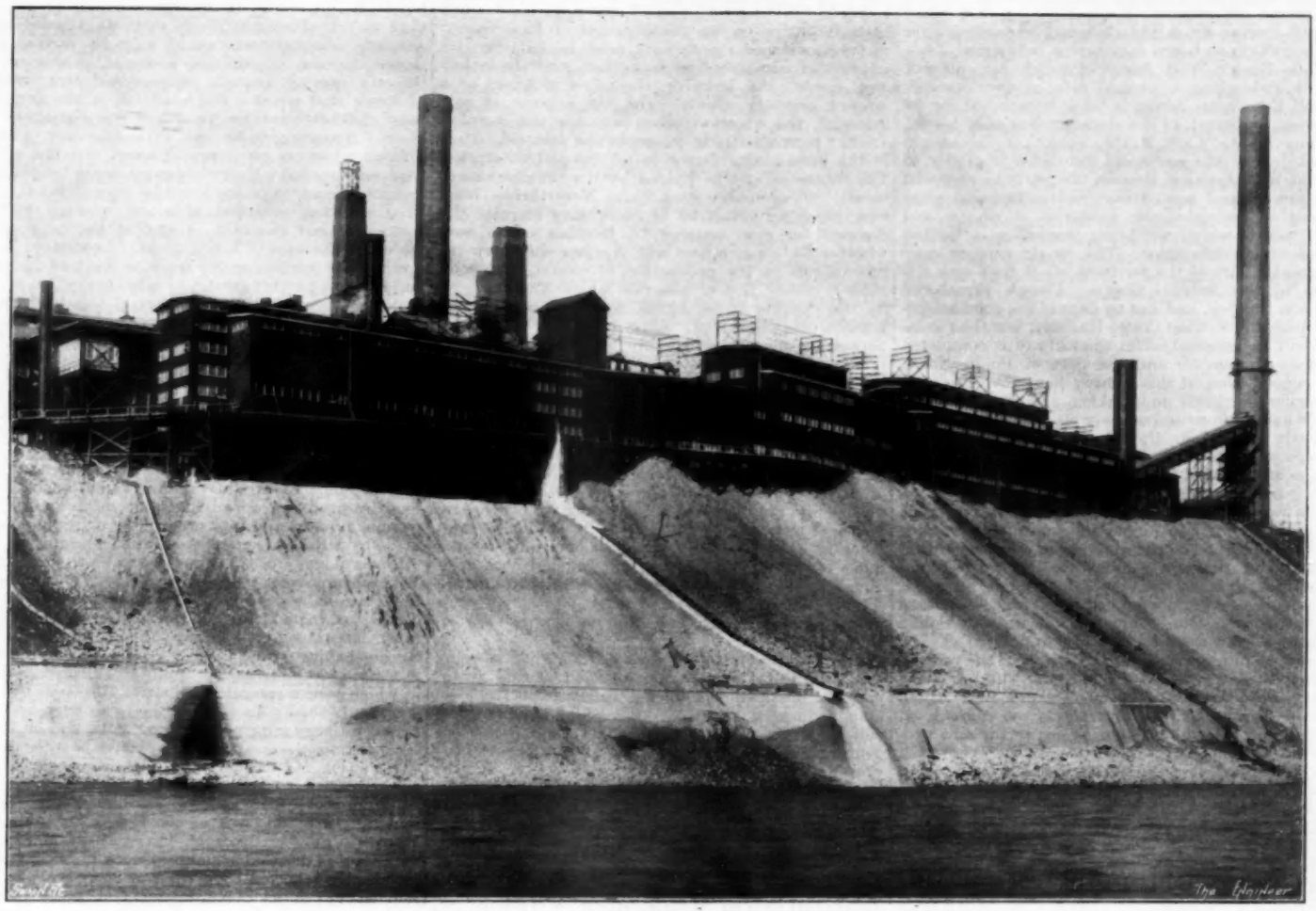
Between the hydrogen and nitrogen plants there will be three huge cylindrical gas containers, 55ft., 60ft. and 90ft. in diameter, the largest to receive and store under pressure hydrogen from the hydrogen plant, the smallest to store nitrogen and the one of of medium capacity to hold a mixture of these two gases from which the ammonia will be made. The hydrogen plant will produce hydrogen by the electrolysis of water, while in the nitrogen plant, air will be liquefied, thus separating the nitrogen from the oxygen. In the ammonia plant, the mixture of gases, consisting of 1 part of nitrogen to 3 of hydrogen, will be compressed under 4500 lb. pressure and passed through a heated catalyst, whereupon anhydrous ammonia will result. Until the ammonium sulphate plant is ready to carry the manufacturing process still further, it is stated that the ammonia plant will not be brought into operation.

The hydrogen plant was, at the end of December, well advanced along in construction. It will measure 285ft. in greatest length by 125ft. in greatest width. A feature of its appendage—the mercury arc rectifier, plant, to convert alternating electrical current to the D.C. needed for the hydrolysis of water—is that it will be the largest installation of its kind on the continent, exceeding by 20 per cent. the previous largest—and first, for metallurgical uses—erected in 1929 by the Consolidated Company at Tadanac in connection with its zinc plant.

The nitrogen plant has now passed the excavation stage. In this plant will be housed the installation to produce nitrogen from the atmosphere by the Claude liquid air process. This building will be about 185ft. by 152ft. when completed. The ammonia and ammonium sulphate plants complete the ammonia series of manufacturing units.

On the right half of the manufacturing area are situated the buildings connected with phosphate, the first of which is the huge phosphoric acid plant, or phosphate plant, in which superphosphate fertiliser will be produced by the application of sulphuric acid to phosphate rock derived from the company's phosphate workings at Fernie, in British Columbia, or from other sources. The plant, designed to turn out 300 tons of triple superphosphate per day, will use for the treatment of the phosphate rock the sulphuric acid produced at the Tadanac metallurgical

ZINC RECOVERY WORKS AT TRAIL, BRITISH COLUMBIA



SLAG FUMING PLANT

works from smelter gases. The phosphate plant is of very considerable dimensions. It will be 334ft. long and 116ft. wide, with part of the plant 90ft. high and the rest 50ft. This plant, now under construction, is being built in a very substantial manner with concrete foundations, while no less than 192 concrete columns and 1050 tons of structural steel will go into its making.

Belt conveyors will carry the superphosphate to a huge storage structure, 460ft. in length, 105ft. in width and 40ft. in height. Rapid progress is being made in the construction of this building, which has involved a large amount of excavation amounting to the removal of 55,000 cubic yards of earth for the bins that are to extend 25ft. below ground level. The huge storage is required because the fertiliser business will be mostly done in three spring months, thus requiring nine months' storage. A travelling crane with clamshell bucket, will scoop up the stored fertiliser and drop it into the hoppers of the shipping mills, of which there will be six to sack the product for shipment.

Something like 35,000 to 40,000 H.P. of electrical energy will be required for the chemical fertiliser plant at its first unit stage, and this power is to be supplied by the West Kootenay Power and Light Company, a subsidiary of the Consolidated, and furnished through a sub-station on the property. Most of the power will go to the mercury arc rectifier installation.

Process heat and heat for the buildings in winter will be piped from the fuming plant of the Tadanac smelter, where waste or by-product heat, amounting to 2500 H.P. is available, and is used to provide central heating for Tadanac, Warfield, and even institutions in the city of Trail. The more important connection with the Tadanac smelter, however, is the sulphuric acid pipe line. Utilisation of the large quantities of sulphuric acid which could be manufactured as a by-product by the contact process from the smelter gases, was a main consideration leading to establishment of the fertiliser industry. This arm of the fretiliser industry is, therefore, at the smelter property, where a 35-ton per day sulphuric acid plant has been producing for a year, but now the first of three additional units of 112 tons each is under construction, these plants to give a combined capacity of 336 tons of acid per day available for fertiliser manufacture. The entire sulphuric acid plant will be ready for action this year. Connection to the fertiliser plant will be by a surface pipe 6000ft. long and 4in. in diameter.

Trade and Foreign Colonies.

(By our own Correspondent in Paris.)

No. III. *(Conclusion)*.*

FRENCH AFRICA.

THE French Colonies that are most likely to influence foreign trade are those forming a continuation of France, though separated by the Mediterranean, and thereby constituting an Empire extending from Dunkirk to the Congo. The idea of this continuity impresses the French imagination. It is the principal factor in determining the active policy that is being carried out for the development of the African Colonies. There is another separation by the Sahara Desert, which has raised a particularly difficult problem of transport. It is not that the technical difficulties in constructing a railway over 1200 miles of desert are great, for these have been overcome and plans have been prepared for a railway over a route that avoids shifting sands and employs oil-driven locomotives. The trouble arises from economic considerations, for there cannot be sufficient traffic to make the railway pay until the Niger Valley is well developed. The expectation that this area would provide a vast cotton-growing territory is not justified in view of the experiments that have been made with all kinds of cotton. The climatic conditions are unfavourable to a cotton-growing industry. There are winds from the Sahara that burn the crops, and heavy rains during periods when they require dry weather. Nevertheless, the probable failure of this attempt to do with the Niger what has been accomplished with the Nile for cotton growing in Egypt does not mean that there will necessarily be a reduction in the programme of works to be carried out in that region. There are plenty of other crops that will justify the execution of the works, which are already advanced, for the irrigation and drainage of the alluvial plains and marshes on each side of the Niger, as well as the hydro-electric installations which may probably supply energy for the railway to Dakar. The experimental lateral canal of Sotuba with a barrage was opened early in 1929. For the moment, there is little goods traffic for a Trans-Saharan railway, and the passenger traffic can be dealt with by aeroplanes and motor cars, the latter having already proved their suitability for the work. Nevertheless, the Trans-Saharan Railway will almost certainly be put in hand at an early date. The Government opposes the construction on account of its cost and its doubtful financial success, but public opinion is altogether in favour of the scheme, and more than one-half of the Deputies have signed a petition urging that the railway should be constructed. Hence, apparently, the Bill can hardly fail to pass the Chamber of Deputies. This will not be done until after the conference which will be held during the International Colonial Exhibition to discuss the matter fully. It has been reported that the British and Italian Governments have been invited to send delegates, presumably because the scheme interests both countries, in the sense that the Italians propose to construct a railway from Tripoli to the Niger and the French Trans-Saharan Railway will compete with the Cape to Cairo Railway, since it is hoped eventually to link up the Trans-Saharan with the Belgian Congo system and the Rhodesian railways.

From a goods-carrying point of view, the Trans-Saharan offers no advantage to the West African territories. The Niger Valley is served by the railway from Bamako on the Niger to Thiès, where it joins the line between Dakar and Saint-Louis, so that goods are sent to Dakar for shipment direct to Marseilles. The sea freights are considerably less than would be the cost of transport over the desert. Dakar is the only deep water harbour on the western coast. Port Saint-Louis is at the mouth of the Senegal River, and is so inconvenient that it has been practically abandoned by shipping. Despite its great development of recent years, Dakar has not been able to keep pace with the expanding traffic, and further extensions are to be carried out. This is part of the programme of colonial works involving a considerable expenditure, which has been recently sanctioned by the Chamber of Deputies. So far as West Africa is concerned, the plan consists in linking up the railways through the various colonies on the coast, so as to provide a system that will join the Niger Railway, and at the same time new ports are to be created at some of the colonies, notably in the Ivory Coast, where the difficulty of providing safe anchorage in sufficiently deep water is very great. What will be done eventually in the Niger Valley it is not easy to foresee, as it will depend upon the extensive production of raw materials adapted to the climate. Products that are grown on a small scale by natives for their own use may not necessarily prove successful on big plantations. In the colonies along the coast, however, production is rapidly increasing, and last year Senegal exported more than half a million tons of ground nuts. Except in a few cases, the imports exceeded the exports, the Sudan, for example, taking 93 million francs of imports as compared with 3½ million francs of exports. There are two main reasons

* No. II. appeared July 10th.

for this, one being that a large amount of material is imported for public works, and the other that some colonies, like Senegal, export practically only one product and have to import everything else. During the period of railway, road, harbour and other colonial equipment, it is obvious that the colonies are of great value to home engineering industries.

While French West Africa is mainly agricultural, and is undergoing a normal rate of development, French Equatorial Africa is being prospected for its minerals, and work of development has only begun. No one knows what is the wealth of Equatorial Africa, but as the geological formation is similar to that of the adjoining Belgian Congo, it is supposed that the mineral wealth may be similar, and prospecting has revealed the existence of copper and other metals which are being worked to a limited extent under difficulties. The jungle extends over the greater part of the territory, as it does over the north of the Belgian Congo. French Equatorial Africa is isolated, and has to depend for communication upon the Belgian Congo Railway, but that isolation will be removed when the railway is completed between Brazzaville and the port of Pointe-Noire. The construction of this railway has proved to be a particularly difficult undertaking. It passes through jungle and swamps and up over the Mayombé Range, where it reaches an altitude of 1380ft. There are numerous viaducts, and a tunnel through Mont Bamba has a length of 5350ft. When the railway was started from Brazzaville, native labour was recruited over a large territory and was employed for porterage and track laying. In jungle and unhealthy swamps, the men died in thousands through unaccustomed work. This disaster showed the French colonial authorities that native labour could not be relied upon, and the work was suspended until chainless track tractors, steam shovels, light railway rolling stock and other material could be imported. At the Colonial Exhibition there are dioramas of the railway showing the old methods of construction and the new. All the heavy work is now done mechanically; Africa has become mechanised. The railway was also started from the other end at Pointe Noire, and is now progressing satisfactorily. At Pointe-Noire there is a spit of land which is to be extended by a mole to reach a depth of 10 m., and a basin and wharves will be constructed on the north side. The place was absolutely destitute of fresh water, which is now obtained from a small lake 20 miles away.

The problem set the French administration is to open up and develop an enormous territory with an inadequate population. In French West Africa there is a population of 14 millions over an area of 4,800,000 square kilometres, by far the great majority being settled along the coastal belt. In Equatorial Africa the population is 3,000,000 for a territory four times as large as France, and the natives of this Central African Colony are physically inferior. In Senegal, Guinea, and the Ivory Coast, the natives are doing good work in association with Europeans, who have installed factories and have introduced machinery wherever possible. The natives are usually good craftsmen, and can be trained as satisfactory mechanics. They can take charge of machines and keep them in running order. Those colonies capable of producing large quantities of raw material can only be developed with the aid of machinery. The problem is one for engineers to solve. There can be no question of European settlement, and the most must be made of native labour by supplementing it with machinery, which means that while plantations will be laid out by Europeans for cotton and other produce, the greater part of the raw material will be supplied by natives who are being trained to modern methods of cultivation. In Equatorial Africa it is probable that, for a long while to come, colonial enterprise will be confined to mining, and here again natives will have to be employed under conditions that will reduce physical labour as much as possible. Although the hopes of an intensive production of raw material are not likely to be realised at an early date, the returns of trade last year, nevertheless, showed that the African Colonies are increasing their exports, and when the trade depression comes to an end the progress will be still more rapid. Now that the great financial plan has been approved of, whereby the colonies will be provided with the money necessary to complete the network of roads which are to open up communication in territories that would cover Europe and to construct railways and ports and introduce mechanical methods into colonial agriculture, the African possessions will provide a good deal of employment to home engineering industries. The Trans-Saharan Railway scheme owes its probable successful launching to the support given to it by engineering companies, which will benefit considerably from its construction. In time, Africa may become a vast factory where European capital and supervision will utilise modern facilities to enable native labour to produce the maximum under the most economical conditions.

The African Colonies cannot be looked upon solely as a source of activity for the engineering industries. They must provide a market for other goods, and the French policy aims at increasing the purchasing power of the native populations. The natives are encouraged to extend their own productions. There are professional schools which instruct them in modern methods and train them to modern ideas. The process is a slow one. Nevertheless, natives learn that they are bettering their condition and are extending their requirements, and that will, eventually, have a notable effect upon the import trade. Because all labour is required for the production of raw material, there is little incentive to the development of local manufactures, so that the exports must be balanced by imports of manufactured and other goods to satisfy local needs. As, however, the value of Africa as a market depends mainly upon the exports of raw material, the question arises whether the supplies are not permanently in excess of the demand. That is the determining factor in all colonial enterprise. The future cannot be judged by the present exceptionally unfavourable conditions. Nevertheless, however much an industrial recovery may increase the demand for raw material, it remains to be seen whether the consumption will overtake the enormous possibilities in the production of cotton, oil, wool, rubber, hides, fibres, minerals which are provided by the opening up of Africa, accompanied by ever-growing supplies from other countries. What is happening now is sufficiently instructive. Senegal is a great exporter of ground nuts because that is the most suitable crop, but it has ruined the olive oil industry in France and North Africa, and Senegal is suffering severely from the depreciated value of its staple product. France is obliged to limit the imports of grain and wine from North Africa in the interests of home growers. Therefore, the immediate future, at any rate, lies in finding new sources of consumption for colonial products and in increasing the purchasing power of the Colonies themselves. Colonial development in French Africa is an excellent thing for the home engineering industries, but colonial prosperity obviously depends upon the value of products, which can only be maintained more or less by restriction, as in the case of rubber, and that necessarily restricts colonial activity.

The conclusion to be drawn from what is being done in the Colonies, as revealed at the International Colonial Exhibition in Paris, is that so long as money is spent on colonial equipment it will help the engineering industries, and motor car firms will be particularly favoured, but unrestricted supplies of raw material resulting therefrom may be a cause of impoverishment, unless each Colonial Power is able to absorb the products of its own Colonies.

Institution of Mechanical Engineers.

SUMMER MEETING AT CAMBRIDGE.

THE summer meeting of the Institution of Mechanical Engineers began at Cambridge on Tuesday of this week. The President, Lieut.-Col. E. Kitson-Clark, the Council and the members of the Institution and the ladies accompanying them were welcomed to Cambridge by the Vice-Chancellor of the University, Mr. A. B. Ramsay, in the Senate House, and, as befitted the place, if not the occasion, the Vice-Chancellor's address was delivered in Latin. In its course he made kindly reference to the President's period of residence as an undergraduate at Trinity College, during which time he had acquired that love for the ancient poets which had remained with him throughout his after life as an engineer. Colonel Kitson-Clark, in his reply, recalled his first acquaintanceship with the Senate House. It was in 1877, and Charles Darwin was being given his degree. Darwin, he remarked, was a student of organic mechanism. To-day the University was extending its welcome to students of inorganic mechanism. The Vice-Chancellor having briefly acknowledged the President's remarks, retired, accompanied by his silver mace bearers, and the professional business of the meeting began.

The first item on the programme was an address on

"CAMBRIDGE AS A PLACE OF EDUCATION,"

by Professor C. E. Inglis, Professor of Mechanism and Applied Mechanics and Honorary Secretary of the local Reception Committee. The address, witty and learned by turns and delivered throughout in a charming manner, delighted all who were privileged to hear it. It covered not only the foundations of Cambridge as a seat of learning and the development of an engineering department under Willis, James Stewart, Sir Alfred Ewing and Bertram Hopkinson—and under Professor Inglis himself, it should be added—but discussed the relationship of education to industry in a fresh and encouraging way. It is an address which will well repay close study, and accordingly we reprint it elsewhere in this issue.

LOCOMOTIVE EXPERIMENTAL STATIONS.

Following Professor Inglis' address, Mr. H. N. Gresley presented a paper describing existing and proposed plants for testing locomotives, including one which it was suggested might be suitable for erection in this country, as contemplated by the committee over which Sir Alfred Ewing presides. The paper is reprinted in full on other pages.

The discussion which ensued did not go deeply into the subject. The principal contribution to it was made by Professor G. Lomonossoff. He expressed himself as being in entire agreement with Mr. Gresley in his argument that the rational design of new forms of locomotives must be based on the scientific investigation of previously constructed engines. Such investigations were a feature of the work carried out by the German and Russian railways and had proved very useful. He agreed, too, with Mr. Gresley that scientific investigations could only be carried out under uniform conditions, such as constancy of throttle opening, cut-off, pressure and temporature of steam and speed. The most important and the most difficult condition to secure was constancy of speed. According to his own experience it was more difficult to secure constancy of speed in a test plant than on the road. Every ordinary steam locomotive had a tendency to rotate about its main vertical axis. That rotation produced a lateral reaction of the flanges against the rails or against the supporting wheels in the case of a test plant. In modern locomotives the reaction might reach as much as 20 tons, and in a test plant it greatly affected the action of the brakes. To control the reaction at full load great skill and experience were necessary. In his own laboratory tests with a steam locomotive giving a draw-bar pull of about 15 tons at an intended speed of about 10 miles an hour the speed had been observed to fluctuate by ± 17 per cent. On the other hand, the speed fluctuation of ordinary locomotives on the road had been observed in Germany and had been found to be not more than ± 1 per cent.

It was interesting to note, he continued, that the first attempt to obtain uniform conditions on the road by means of an auxiliary locomotive after the manner now successfully used in Germany had been made by Mr. Loevy in 1886, and was described in the "Proceedings" of the Institution for that year. That attempt was unsuccessful. In 1900 he, Professor Lomonossoff, succeeded in securing the same uniform conditions, more or less, on the road as those realised in the laboratory by selecting for the tests sections of the line having uniform profiles. The Russian method of testing locomotives was finally established in 1908, in which year a special Locomotive Research Bureau was established. In that method the engines were tested on very long uniform gradients, and on short level sections the speed was kept constant by braking. The cut-off and throttle opening remained constant throughout the trials. In Poland sufficient lengths of uniform gradients were not available, and accordingly in 1923 the chief of the Polish Experimental Bureau, Professor Czeczott, initiated the method of maintaining uniform speed by means of an auxiliary locomotive followed by a train of carriages. In the hands of Professor Nordmann and Herr Günter brilliant results had been obtained by that method in Germany.

He fully agreed with Mr. Gresley that tests with locomotives must be conducted under conditions as nearly as practicable the same as those under which the locomotives worked on the road. According, however, to his experience with steam locomotives, it was impossible to realise the requisite similarity of conditions in any laboratory. The main difficulty was not caused by the absence of wind or the presence of friction at the axles of the supporting wheels, but was traceable to the boiler. On the rails the whole engine vibrated vertically, and as a consequence the evaporation was always better than when the same engine was tested under laboratory conditions in which vibration was absent. At the same time the vibration on the road increased the wetness of the steam and, as Sir Alfred Ewing had pointed out, thereby greatly augmented the cooling effect of the cylinder walls. Tests with the same locomotive using the same fuel showed that on the rails it gave 40 per cent. more steam than it did in the laboratory, but that the steam had a dryness fraction of only 0·94, as compared with 0·98 under the test plant conditions. On the rails, therefore, it could be said that the power of the boiler was increased, but the efficiency of the engine was decreased.

He did not wish it to be understood that he was opposed to locomotive testing laboratories. In many respects they were invaluable, particularly for testing new details and entirely new types of engine, such as oil-engined locomotives and turbine locomotives. Nevertheless, laboratories, even with wind tunnels, could not give figures that could be applied without correction to actual running conditions. It was for that reason that in Germany and Russia, in spite of the fact that in both these countries locomotive testing plants existed, principal reliance was placed on the tests carried out on rails. Concluding, he mentioned the fact that the first locomotive testing laboratory was established at Kieff in 1882 by a late member of the Institution, Alexander Borodin. It was described in the Institution's "Proceedings" for 1886.

Mr. W. A. Stanier, speaking with experience of the locomotive testing plant at Swindon, confirmed Professor Lomonossoff's assertion as to the difficulty of obtaining uniform conditions in such a plant, and particularly as regarded constancy of speed. The bearings and gearing of the test plant were a constant source of difficulty, and in that respect Mr. Gresley's design with ten sets of bevel gearing, two spline shafts and several cross shafts seemed to contain the promise of trouble. Electric traction was looming in the distance. In view of that fact he raised the question whether at this date a steam locomotive testing plant would justify the cost of its construction.

Professor C. H. Bulleid was in favour of the esta-

blishment of a locomotive testing plant on the ground that it was difficult to obtain steady conditions on the road and still more difficult to make variations in the working *régime* of an engine hauling a train to schedule. With a testing plant it was possible to make long runs under set conditions and to fit instruments to the engine wherever they were wanted. He argued that what the Froude tank was to the shipbuilder a testing plant would be to the locomotive builder.

Lieut.-Col. C. H. Kuhne dealt with the testing of mechanical vehicles for the Army, in which work, he said, the difficulties encountered were the same as, but on a smaller scale than, those met with in testing locomotives. At the Military College of Science, at Woolwich, a start had been made with the construction of a testing plant for tanks and similar vehicles running on endless tracks.

Wing Commander T. R. Cave-Browne-Cave expressed doubts as to the value of the wind tunnel proposed by Mr. Gresley. The magnitude of the wind resistance was greatly affected by its direction relatively to the length of the engine, and by the nature of the vehicles following the locomotive. The size of tunnel proposed by Mr. Gresley would, judging from aeronautical experience, not be excessive. In order to economise the consumption of power the regenerative form of wind tunnel might be adopted. In that form the air was circulated round a closed circuit, so that once it was set in motion the energy required to maintain its movement was only that spent against resistance at the walls. In the case of a locomotive testing plant a closed circuit would necessitate the cooling of the air before it was re-delivered past the engine.

Professor F. C. Lea did not think that the difficulty mentioned by Professor Lomonossoff concerning the effect of stationary conditions on the wetness of the steam generated would be very serious. In any event it could be allowed for by a correcting factor. But in the mechanical details there would be real difficulty, in view of the fact that on the road the track was never straight and curves and points were present. It would be impossible to reproduce the effect of these factors in the testing plant. Nevertheless, he held that if there were to be real progress in the steam locomotive a testing plant was essential. He doubted the wisdom of attempting to get any results from such a plant relating to wind effect. In aeronautics we had so far used only models in wind tunnels, and he thought it would be best if the wind effect on locomotives was similarly studied by means of models.

Mr. Gresley, replying to the discussion, said that there was clearly a misapprehension concerning the object of the wind tunnel. It was not intended to reproduce the practical conditions as they affected wind resistance, but as they affected combustion in the fire-box. An engine in still air was not in the same condition as regarded combustion as an engine travelling on the road, and it was in order to secure similarity in that respect that it was proposed to provide a wind tunnel. It was true, as Professor Lomonossoff had said, that vibration was a very important factor in the steaming of a locomotive boiler. For example, the locomotive type of boiler fitted in the early destroyers was a failure because of the absence of vibration. Nevertheless, water-tube boilers of the type now becoming popular in locomotives were much less affected by vibration than the Stephenson type. He fully agreed with the contention that test plant results would not give data that would be directly applicable to running on the road. But the results would be those secured under uniform conditions, and uniformity was most important if comparisons were to be made.

The meeting was then adjourned. The afternoon of Tuesday was spent in visits to the various colleges, and in the evening a reception and dance were held at the Guildhall, by invitation of the Mayor and Mayoress. The rest of the meeting was devoted to visits to works and places of interest in and near Cambridge, Ely, Northampton, Bury St. Edmunds, Henlow, Letchworth and Peterborough. Concerning these visits we hope to say something in our next issue.

BOARD OF TRADE EXAMINATION.

THE certificates of competency issued to sea-going engineers are of two kinds—ordinary certificates, valid for service on board steamships, and motor certificates, valid for service on board ships propelled by internal combustion engines. A candidate may be examined for a second-class certificate, either ordinary or motor, after four years' approved workshop service, followed by 18 months on watch in the engine-room at sea. After he has obtained this certificate a further 18 months in charge of a watch at sea will qualify him for examination for a first-class certificate. Time spent in receiving instruction at an approved technical school may be accepted in lieu of a part of the required period of workshop service. The holder of an ordinary certificate can have it endorsed as valid for service in motorships also, by acquiring experience in motorships and by passing the appropriate examination, while the holder of a motor certificate can have it endorsed as valid for service in steamships on similar conditions. A report of the Board of Trade upon its examinations states that 465 motor certificates issued in 1930 included 259 endorsements of ordinary certificates for service in motorships, and 254 of these were endorsements of first-class certificates. The total number of candidates examined, during 1930, including those making repeated attempts, for engineer certificates of all grades, both ordinary and motor, was 4331. The total number of separate individuals examined was 2656, and of them 1833 succeeded after one or more attempts in obtaining certificates during the year.

British Chemical Plant Exhibition.

A LITTLE exhibition, but one of the most interesting. That is the impression which we have carried away from a visit to the British Chemical Plant Exhibition, now being held in the Central Hall, Westminster. It will close on Saturday, the 18th.

It is little only in one sense, and that is the space which it occupies, for there is not much range for the display of the full-sized plant used in chemical manufacturing in Central Hall. But our technicians have succeeded in bringing together in the space available an unusually typical "pantomime" of the present state of the art of handling bulky materials to further the discoveries of researching chemists. The word "pantomime" may not seem appropriate to such an occasion to everybody, but we use it quite deliberately, for many of the exhibits explain themselves in dumb show. Nevertheless, we have found, in conversation with the men on the stands, a really unusual degree of keenness to give to their visitors a thorough insight into the technicalities of the plant or processes with which they are concerned. The organisers of the Exhibition are also to be congratulated on the facilities which they have provided for the dissemination of information.

It is now some five years since such an Exhibition was held in London, and in the interval considerable changes have taken place in the industry. The private research laboratory has become far more prominent than it was a decade ago, and the results of research are being attended to far more seriously by the heads of manufacturing firms. The result is not merely an improvement in the qualities of the materials used for many purposes, but also the adaptation of known materials, perhaps in a modified form, for purposes other than those to which they were habitually confined.

This side of the Exhibition is well exemplified on the stands of the Society of Chemical Industry, which, by the way, is about to hold its jubilee, although it is evident in many other parts of the show. The research exhibits have been organised by the Chemical Engineering Group in co-operation with the Department of Scientific and Industrial Research, the National Physical Laboratory, the British Non-ferrous Metals Research Association—of whose new laboratory we gave a description on June 12th—and a number of other associations. There are seven stands in this section, which cover a very wide range of industry, much of which is directly of interest to engineers. Thus there are some samples of valves which have been used in apparatus for the hydrogenation of coal and, consequently, must be able to withstand high temperatures and pressures. There are various types of pulverised fuel burners, a number of exhibits connected with the rubber industry, some concerned with building materials and their preservation, and an extensive section devoted to alloys for use at high temperatures.

The early association of the engineer with the chemist is exemplified in the special section devoted to autoclaves, where we gathered that Frankland was assisted, in about 1855, in the construction of his autoclave by Naysmith, of Manchester. The receptacle was made of forged Low Moor iron. Modern autoclaves are, of course, made of many other materials, and several are shown.

There are, for instance, the vessels made by Thompson Bros., Ltd., of Bradley, Bilston, which are coated with vulcanised rubber to protect them against chemical attack. The steel vessel is first shaped and is then covered with the rubber by a special process, and it is, naturally, essential that the coating should be without blemish, otherwise the vessel might be quickly ruined. In order to test the continuity of the rubber covering its surface is brushed over with a wire brush charged electrically to some thousands of volts, while the metal of the vessel is connected to the other pole of the circuit. In the event of there being an imperfection the voltage is sufficient to burn the rubber locally and show that it requires repair. Another way in which this firm combats corrosion from electrolytic action is to ensure that the filling metal used in making welds is of such a composition that when the weld is completed the weld shall be of the same characteristics as the parent metal and consequently produce no electromotive force.

We had a most interesting conversation with the representative of Silica Gel, Ltd., Bush House, Aldwych, London, W.C. 2, on the varied applications of the gel. It is what might be described as plain sand with an ultra-microscopic structure and consequently has a remarkable adsorptive capacity. It is estimated that a cubic inch of the material has a surface area of one acre. As a consequence it can be used to extract moisture from air and gases by attraction, not chemical absorption. The moisture can then be driven off again by applying heat and the gel is returned ready to take up service again. One of the latest applications of the idea is in the "breathers" of electrical transformers. The breather, naturally, passes some air into the transformer casing, and this air may bring in moisture to the detriment of the insulation. By packing the breather passage with silica gel the moisture is entirely kept back. The material is supplied in convenient cartons and each one is, we are told, good for a year's service.

Industrial Waste Eliminators, Ltd., of 20, High Holborn, London, W.C. 1, show a steam turbine-driven centrifuge for the extraction of grease and oil from waste materials, such as cotton waste, swarf, axle-box packings, and so forth. It is illustrated by the line drawing Fig. 1. The casing is a single-piece iron casting and is fitted with a dished sheet steel lid

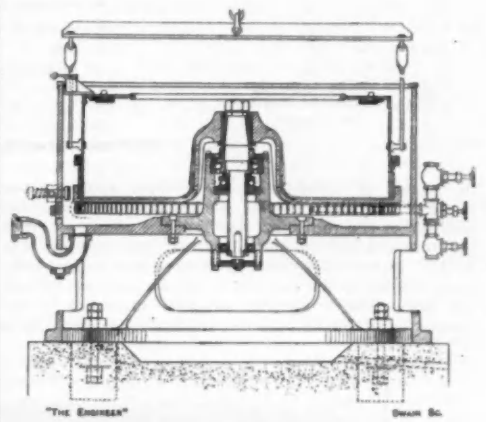


FIG. 1—TURBINE CENTRIFUGE—INDUSTRIAL WASTE

with a counterweight. The lid can be screwed down by means of clamps. The revolving dome and shaft column are of cast steel and the latter is filled with oil for the lubrication of the ball and roller bearings of the shaft. The basket for holding the waste is removable and is lifted into the machine by means of a bale. It stands in a shallow saucer-like container, which is also perforated. Beneath the saucer there is a ring of turbine vanes, which are acted on by steam from a nozzle and rotate the basket at a high speed. The exhaust steam at the same time softens the grease in the waste and helps in its extraction. The mixture of oil and water leaving the machine by the syphon pipe seen on the left is led away, settled out, clarified, and the oil or grease can then be used again. It is usual to provide two baskets with these machines, so that one may be charged while the other is in service.

Thomas Broadbent and Sons, Ltd., of Huddersfield, are exhibiting a small-scale working model of a continuous self-discharging centrifugal separator, for treating slurry of all kinds, containing up to 10 per cent. of fine solids. This machine has two baskets, rotating at different speeds. The outer basket, which is mounted on the main spindle, is of the imperforate type, and rotates at 920 r.p.m The inner basket carries a removable spiral, and rotates at 887 r.p.m. in the same direction. The main spindle is hollow, and carries a stationary pinion shaft, and the variation in speeds is obtained by internal gears. The slurry is fed down a funnel, and falls on to the top of the inner basket, from which it is discharged through ports and collected in the outer imperforate basket. The solid contents of the slurry are precipitated on the inner walls of this basket, and conveyed in a downward direction by means of the spiral, and eventually discharged through portholes. The solids are then collected by a scraper drum, and ejected from the machine through a chute. The clarified liquor is discharged over a spilling lip of the outer basket into the liquor chamber, and discharged through the outlet pipe. A machine of this type is treating coal slurry, containing about 10 per cent. solids, at the rate of 2000 gallons per hour. During a recent test the effluent water was found to contain not more than 1 per cent. of solid matter. The recovered coal dust has a moisture content of about 20 per cent. as delivered from the machine.

Bennett, Sons and Shears, Ltd., of 43, Shoe-lane, London, E.C. 4, show an example of Shears' patented Mulser, which is claimed to make emulsions perfectly homogeneous and ensure that they will not separate out again. It is used to finish emulsions which have been roughly prepared in other machines. The action of the Mulser is to pump the emulsion under a pressure of 100 lb. to 120 lb. per square inch through very fine orifices against a revolving disc compressed by a spring against the surface of the plate containing the orifices, which allows the liquid to exude through under any required pressure while it is being rubbed down, and prevents the orifices becoming clogged or blocked.

Elliott Brothers (London), Ltd., of Century Works, Lewisham, London, S.E. 13, show, among a number of other measuring and testing instruments, the smoke density meter illustrated by Figs. 2 and 3. As is

shown in the diagram Fig. 2, the meter consists of a steel tube of about 6in. diameter, fixed across the chimney or flue. An electric projection lamp is fixed at one end, and a radiation pyrometer at the other. Slots are cut in the central portion of the tube so that a definite proportion of the smoke in the chimney passes between the lamp and the pyrometer. The rays from the lamp are focussed on the thermo-couple

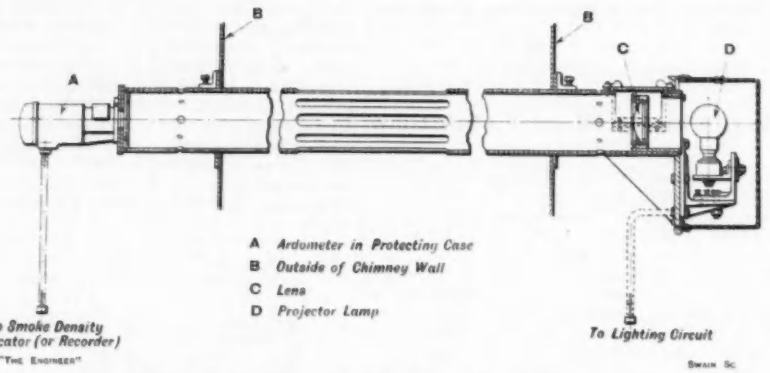


FIG. 2—SECTION THROUGH SMOKE METER—ELLIOTT

by means of suitable lenses. When smoke passes through the slots in the steel tube it reduces the amount of the radiation reaching the couple, so that the temperature of the latter and consequently the E.M.F. generated by the pyrometer will be inversely proportional to the amount of smoke passing through the flue. The projection lamp is connected to the nearest available lighting circuit through a special iron

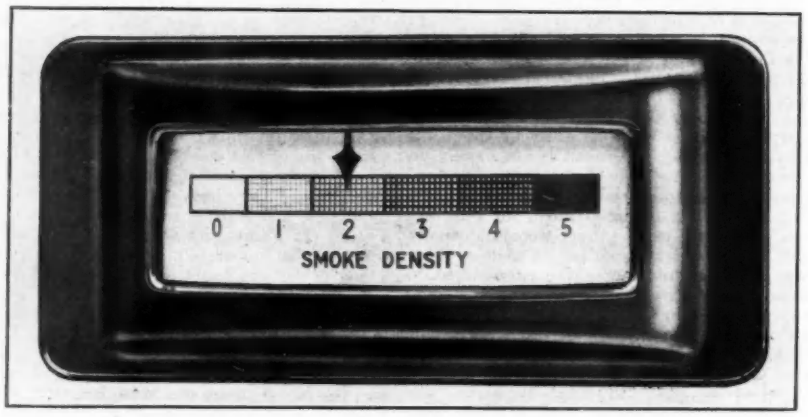


FIG. 3—SMOKE METER INDICATOR—ELLIOTT

wire resistance, which keeps the voltage at the lamp terminals constant. The thermo-couple is enclosed in an evacuated glass bulb, and together with its lens and case forms a self-contained unit, similar to the makers' standard "Ardometer"—or total radiation pyrometer. The ends of the steel tube project about 2ft. from each side of the flue, and a series of holes in these external sections of the tube allow a small current of fresh air to be drawn in by the chimney draught. This keeps the ends of the tube clear of smoke and prevents the deposit of dust and soot on the lenses, which, however, are readily removable for occasional inspection and cleaning if required. The actual indication of the smoke density is provided by a millivoltmeter, which may be graduated as shown in Fig. 3 or in any other convenient scale.

The mixer and sifter for powders exhibited by Wm. Gardner and Sons (Gloucester), Ltd., of Bristol-road, Gloucester, embodies a combination of sifting through wire mesh under the action of a rotary brush and mixing by means of rotary blades in a cylinder. The material to be treated is dropped into a hopper, which has a shaking feed gate. The shaking is effected by a cam on the shaft of the brush below. There is also a diaphragm which can be adjusted to regulate the rate of feed. The powder drops past the brush on to a sieve and is rubbed through by the bristles. The spiral formation of the brush also urges along any masses of coagulated powder which are too large to pass through the sieve into the end compartment of the sieve, where, under the action of the cylindrical brush and cage, the lumps are broken up into powder sufficiently fine to pass the mesh. Any foreign matter which cannot be reduced is discharged through a shoot at the end of the machine. The powder falling through the sieve is caught in a cylinder and thoroughly mixed by rotating puddles.

The G.K.S. Combustion Company, Ltd., of 11, St. Mary-at-Hill, London, E.C. 3, has a novel form of mixer for inks, paints, &c. The liquid is placed in a pot within which there are two vertical shafts equipped with paddle blades. These two shafts revolve in opposite directions, so that the liquid is worked upwards by one set of paddles and downwards by the other. At the same time, they have a planetary movement in the pot to increase the stirring action. The gear for driving the paddles is mounted in a lid which fits on the top of the pot to prevent spilling, but can be raised clear to allow the pot to be tilted for emptying.

The same firm is also exhibiting specimens of a new heat-resisting ferrous alloy, to which the name of "Hercia" has been given. It is a nickel-chromium-cast iron alloy, and has a close-grained structure, the carbon being almost entirely in the combined state. It is strong and tough, and has a tensile strength of 17 to 20 tons per square inch, at normal temperatures. The compressive strength is about 85 to 90 tons per square inch, the melting point being in the region of 1650 deg. Cent. The amount of expansion and contraction depends very largely upon the size and shape of the casting, but, as an indication, the following test figures are quoted:—A furnace fire-bar, 6ft. long, 2in. wide, 4in. deep, was subjected to an intense local heat for a period of three months, and showed on examination a total longitudinal expansion of 0·125in. The material will, we are told, successfully withstand varying or consistent temperatures up to 950 deg. Cent., and does not show signs of scaling at 1050 deg. Cent. "Hercia" can be cast in the same way as ordinary cast iron and is machineable.

The Dorr Company, Ltd., Abford House, Wilton-road, London, S.W. 1, shows a very informative working model of a plant for the lixiviation of phosphatic rock, for the production of fertilisers and several other examples of apparatus for the treatment of ores. Among them there is the rotary filter, of which we give a section in Fig. 4. It is of the vacuum type and has the filtering medium fixed on the inside of the drum. The drum, which serves also as the pulp container, is closed at one end, the other end being open to permit discharge of the filter cake and observation of the filtering operation. The open end is provided with a circular flange which acts as a baffle to retain the pulp within the drum. The inside of the drum is fitted with a heavy screen which supports the filter cloth. This screen is so arranged that a space exists between it and the drum shell to allow free drainage of the liquid drawn through the cloth. The filtering surface is divided into several panels, running parallel with the axis of the drum. The filter cloth is fastened into grooves at the ends of the drum, and along the partition channels which separate adjoining panels. The whole cloth or any portion of it can be removed and replaced quickly. The panels are connected to a main valve which admits pressure and vacuum to each panel in the proper sequence. The drum is mounted on a trunnion bearing at the closed end and is supported at the open end by riding rolls. The drum is rotated in a clockwise direction through worm gear and worm, the worm shaft bearings being integral with, and part of, the trunnion bearing, to insure rigidity and alignment. A cake discharge hopper is mounted inside the drum on supports which extend through both ends of the drum and rest on the foundation. The hopper is fitted with a conveyor which continuously removes the cake and discharges it through the open end of the drum. The feed is usually brought in through the open end of the drum, as shown in Fig. 4, but it may be brought in through a pipe in the closed end, if desirable.

Vacuum is applied between the shell and the filter cloth and causes a cake to form on the cloth. As the drum rotates the cake is dewatered, and washed if it is desirable, until it reaches the discharge point near the top of the drum. At this point pulsations are applied to the filtering medium, which cause the cake to fall off into the discharge hopper, whence it is carried away by a conveyor or chute. In some cases the filter cloth is freshened up by a spray of water or steam before it again goes into action.

Gwynnes Pumps, Ltd., of Hammersmith, has some examples of the Gwynne-Doulton centrifugal pump, which is intended for handling corrosive liquids. It is characterised by the fact that it has a cast iron casing, for mechanical strength, and is lined entirely by Doulton stoneware. The impeller is also of stoneware and is provided with subsidiary blades on the back, which tend to suck away towards the delivery any liquid which might otherwise creep through the stuffing-box and damage the shaft.

W. C. Holmes and Co., Ltd., of 119, Victoria-street, Westminster, have a variety of appliances connected with the coal gas industry, and a cinematograph film showing the erection of plant supplied by the company. There is also an interesting new wet gas meter on this stand, which embodies the general principle of the swash plate with liquid pistons.

Manlove, Alliott and Co., Ltd., of 41, Parliament-street, Westminster, are showing a new form of multiple leaf filter, of which we give an illustration in Fig. 5. This filter was originally devised for handling dry-cleaners' solvents at unusually high rates, but can, of course, be used for other similar purposes. The design was originated by Mr. Hatfield, of Achille Serre and Co., of Walthamstow, and has been elaborated by the makers so that now rates of filtration as high as 80 gallons per square foot per hour are attained.

There is a number of vertical filter leaves built up of a coarse wire mesh foundation covered with filter cloth. Each leaf has a drainage outlet channel at the top and the bottom. The bunch of leaves is enclosed by a casing, which is split and hinged so that it may be opened. A toggle clamping arrangement and rubber gasket make the joint tight. The leaves are supported on two little trollies and can be pulled out of the casing on rails to make them readily accessible. The rails are hinged and can be folded

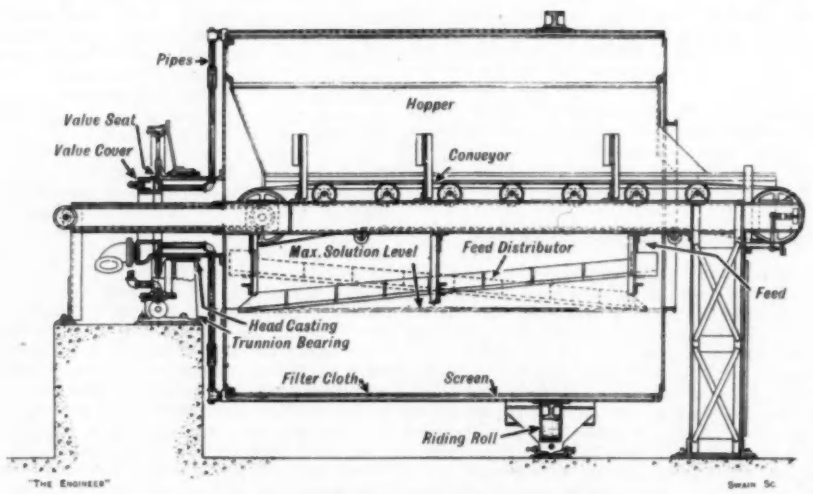


FIG. 4—SECTION THROUGH ROTARY FILTER—DORR

back when the casing door is closed. The liquid to be filtered is pumped into the casing under considerable pressure, and, passing through the filter cloths, escapes through the interior of the leaves. A cake of any solid matter it may contain is deposited on the outside of the cloths, and when the filter is opened the cake is scraped or washed off. The arrangement of feed passages and distributing plate causes the incoming liquid to sweep over the whole sloping bottom of the filter, producing a circulation which is of considerable assistance in building up an even cake. The feed channel is arranged in the joint surface of the filter, and both it and the distributing plate

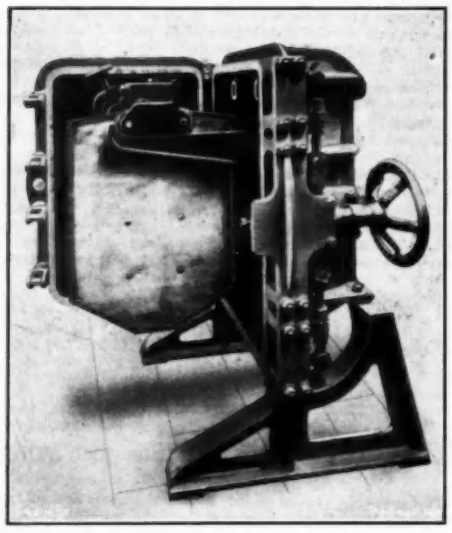


FIG. 5—LEAF FILTER—MANLOVE

are easily cleared, if necessary, when the filter is opened.

Washing may be carried out to great advantage owing to the uniform resistance of the filter cakes, which are not allowed to meet. The space between the cakes allows unhindered access for the wash water, and equal penetration is also assisted by the very free drainage provided in the leaves.

The Tungstone Company, of Market Harborough, is showing a working model of an air-operated pump for corrosive liquids. We give a diagram showing its principle of operation in Fig. 6. The pump, it will be seen, comprises two barrels, which work alternately, one being filled by gravity, while the other is being discharged. The inlets are in the bottom and are controlled by ball valves. The outlets are

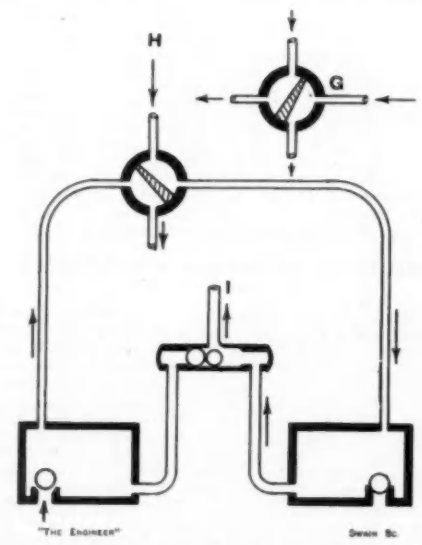


FIG. 6—DIAGRAM OF ACID PUMP—TUNGSTONE

connected together to a common delivery and also have ball valves. Compressed air is alternately admitted to the two barrels to force out the liquid by a rotary valve. As shown in the diagram, the right-hand barrel is being supplied with compressed air and is discharging liquid, while the left-hand barrel is exhausting air and is being refilled. It will be understood that, except for the ball valves, there are no moving parts in contact with the liquid. As a consequence, the pump can be constructed of a very wide range of acid-resisting material. There are actually in use now pumps made of antimonial lead, glass, chemical lead, cast iron, ebonite, cast iron—rubber-lined, acid-earthenware and the non-ferrous metal "Batterium."

Naturally, there are several stands devoted to the display of corrosion-resisting materials, both metallic and otherwise. Most of these products are so familiar to our readers that they only need catalogueing, such as those of Brown Bayley's Steel Works, Ltd.; the Cannon Iron Foundries, Ltd.; Thos. Firth and Sons, Ltd.; Hadfields, Ltd.; and the Haughton Ironac Company, besides several of those dealing with vitreous materials. It was pleasant to observe in this latter connection that the Worcester Royal Porcelain Company has an exhibit.

There are, of course, many other exhibits in the hall over and above those to which we have made reference, and it is impossible in the space at our liberty to deal with them separately, but we can only hope that this notice may induce our readers to go, forthwith, and see the Exhibition for themselves.

Obituary.

ARCHIBALD FULTON CRAIG.

WE have to announce with regret the death of Mr. Archibald Fulton Craig, founder and chairman of the firm of A. F. Craig and Co., Ltd., at his home in Paisley last week. If he had lived until next January he would have completed his ninetieth year. His life was one of great interest, since he had travelled to many parts of the world and had been present at many memorable incidents.

He was born in January, 1842, and was educated first at Paisley Grammar School, and later at Glasgow University. After serving his engineering apprenticeship with a Paisley firm, he travelled to America in search of experience. As his visit to that country coincided with the period of the American Civil War, his experiences were not wholly connected with engineering. He was present at many exciting scenes. American feeling was running somewhat high at the time against England, and he was forced to listen on several occasions to strong language addressed against the conduct of this country.

Returning to England in 1868, he founded the firm which bears his name, setting up the Caledonia works in Paisley for the production of iron castings, and for boiler-making. Since that date, under his capable management, the history of the firm was one of steady progress. In 1895 the decision was taken to convert the business into a limited liability company, of which Mr. Craig became chairman. In connection with his firm, which supplied machinery to many countries, Mr. Craig twice completed world tours, visiting Australia, China, Japan, Canada, the United States and Egypt, among many other places. In 1918 the firm celebrated its jubilee, and Mr. Craig received an address and a silver casket from the directors, the staff and the employees.

All his life Mr. Craig was interested in philanthropic and charitable work, early becoming associated with the Paisley Industrial School and the Paisley Technical College, while he was also deeply interested in the welfare of the Royal Alexandra Infirmary. He was first a director and later president of the industrial school, now known as the Thornly Park School, and during his term in the latter office, which lasted twenty years, many improvements were made. He was a governor of the Technical College.

Outside his engineering work he was deeply interested in the preservation of antiquities, and devoted a considerable amount of time and considerable sums to the preservation and restoration of Paisley Abbey. His death will be felt as a heavy loss not only by engineers, but also by many others in other walks of life.

STANLEY FABER PREST.

IT is with great regret that we record the death, on Saturday last, July 11th, at Shalford, Surrey, following an operation, of Mr. Stanley Faber Prest, chairman of Parsons Marine Steam Turbine Company, Ltd., and director of C. A. Parsons and Co., Ltd., and other companies. It will be recalled that in March last Mr. Prest was unanimously elected the chairman of Parsons Marine Steam Turbine Company, Ltd., to succeed the late Sir Charles A. Parsons. Mr. Prest, who at the time of his death was 72 years of age, was born at Sherburn House, Durham, in December, 1858, and was the second son of the Venerable Edward Prest, D.D., Archdeacon of Durham. He was educated at Durham School and at Glasgow University, and was subsequently a pupil engineer at the Newcastle works of R. and W. Hawthorn. Later, he spent some time at Armstrong's Elswick Works, and then went to Barrow-in-Furness as manager of the firm of Westray and Copeland, a position which he held for six years. He then came to London, and from 1905 to 1920 was director and chairman of Eley Brothers, subsequently becoming a director of Nobel Industries, Ltd. He was associated with Sir Charles Parsons from the beginning of the development of the Parsons steam turbine. Mr. Prest was a member of the Institution of Naval Architects, the North-East Coast Institution of Engineers and Shipbuilders, and the Iron and Steel Institute. He was also recently elected to the Court of the Worshipful Company of Shipwrights. He was a member of the Athenæum and St. Stephens Clubs, and was well known both in London and the North-East Coast, where he had many personal and business friends.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

LONDON'S UNDERGROUND WATER.

SIR,—In your issue of July 10th, you kindly devote one of your leading articles to a contribution of mine on the "Depletion of London's Underground Reservoir," which appears in the current number of *The Chamber of Commerce Journal*. In your comments on this matter there are one or two points to which I should like the opportunity of replying. The question of filtration is, I admit, one of the major questions, especially as regards the degree of purification required to eliminate any possible danger in such a scheme of recharging underground reservoirs either in the London area or elsewhere, and is one of the many points requiring detailed investigation.

Although I coupled up the Thames floods with the falling water table as complementary troubles, the recharging of the chalk was my sole idea, and it was never intended to confine the scheme to the draining of flooded areas, though, in certain cases, this might be feasible. Essentially my idea is to draw off water from the Thames and its tributaries at suitable points from which it could be led to wells or shafts sunk in close proximity. This would not be confined to actual periods of flood, though it would have to be curtailed or stopped in periods of drought when conservation of the river water was necessary.

As regards pollution from corroded wells, you say the proposal "in any case does not abolish the acknowledged contamination that is taking place through worn away well linings," but should such a scheme prove feasible and could the static level of the chalk water be eventually raised as high, or higher than, the static level of the tertiary sands carrying brackish or salt water, this source of pollution would be practically eliminated.

You ask "What would be the object of letting it—*i.e.*, the water—sink some hundreds of feet into the ground in order to pump it up again?" My answer is, to utilise the vast storage and distribution system which Nature has provided under London. Surely, there is nothing essentially different in this from pumping river water to an artificial reservoir and then pumping it out again to the consumer. Moreover, the more the chalk could be recharged the less pumping would be required to recover this water due to the rising, instead of falling, water table.

In this general question of natural underground storage, it is, perhaps, interesting to note that in the last year or two considerable attention has been given in America to the question of utilising dry sands under suitable structural conditions for the storage of surplus oil and especially gas.

JAMES ROMANES.

London, July 13th.

THE LEWIN LOCOMOTIVE.

SIR,—I was greatly interested to read the article by Mr. Geary in this week's issue of THE ENGINEER, and would like to point out that there is a locomotive still running, as your correspondent surmises, at the Swanscombe Works, Associated Portland Cement Manufacturers, Ltd. It is named "Erith," and is 0–4–0, well tank below the footplate, built 1875. The cylinders are 9½in. by 18in., driving on the rear wheels. The excentrics are upon the front axle, placed beyond the wheels in the same plane vertically as the axis of the cylinder. The valves, which are on top of the cylinders are operated through the medium of a rocking arm, which has its fulcrum upon the front cylinder cover, and its lower extremity is forked to embrace the die block of the expansion link. The wheels are 30in. in diameter; the boiler pressure 140 lb.; the cylinders, of course, are inclined. Mr. Lewin built more than twenty locomotives in all at his works in Mount-street, Poole, and I believe retired from business in 1879. The practice of using inclined cylinders was really only the sequence of the evolution of the locomotive cylinder of Hackworth's day, which was vertical, and the horizontal or slightly inclined cylinder of the present day. This marks a period when the inclined cylinders had not quite passed out of fashion, as there was a locomotive running upon the Llanelly Railway, built in 1864, by Messrs. Fossick and Hackworth, of Stockton, the cylinders of which were most steeply inclined, almost reaching to the base of the chimney. A number were built, also, I believe, by Messrs. Kitching, of Leeds.

G. GEO. WOODCOCK.

London, July 11th.

CREDITS AND INDUSTRY.

SIR,—Whatever may be thought for or against the desirability of providing credits for, for instance, Russia, it seems desirable that the meaning of the transaction should be understood.

A 10 millions credit for, say, Russia, means, in effect, that cheques on the Bank of England to that amount will be honoured. Assuming that these are spent on British goods, a proportion of the sum so spent goes in wages and salaries, and, possibly, in profits to the manufacturer, and the goods, when made, are despatched out of the country to Russia. Assuming that the credit be repaid by the purchase of British exchange, the sum so obtained would be paid to the Bank of England, which would cancel both it and the original credit, the result of the transaction in this form being that both the manufacturer and the

British nation as a whole had done the work and supplied the material and goods for nothing.

Until the credit is repaid, and assuming the whole of it to be spent in this country, there is 10 million more pounds of effective demand than would otherwise be the case; but no corresponding increase in the amount of goods available. In other words, wages, salaries and profits so obtained are pure inflation, and the work which they represent is done without any genuine remuneration.

C. H. DOUGLAS.

London, July 10th

SIXTY YEARS AGO.

IN our issue of July 21st, 1871, we were concerned with the conditions on which steam-driven vehicles were allowed to ply on the common roads. The Acts controlling the question were those of 1861 and 1865. In these days of high road speeds, those of the younger generation will have difficulty in believing that among the conditions laid down were that the speed of travel was limited to two miles per hour in towns and four miles an hour in the country. Nor will they easily credit the facts—well remembered by their elders—that a man with a red flag had to precede steam road vehicles at a distance of 60 yards, or that at least three persons had to be employed to drive or conduct such locomotives, and that if there were more than two trailing vehicles there must be an additional man to take charge of them! Is it to be wondered at that there was an outcry against such restrictions? In the issue in question we reprinted three petitions, urging their removal or modification, which had been addressed to the President of the Board of Trade. We also published a memorandum discussing these petitions, which had been prepared by a Captain Tyler, who was evidently a Board of Trade official. With the majority of his recommendations we expressed ourselves as in agreement, though we took exception to some of them. There could be no doubt, we said, that the petitions expressed the wishes of a large section of the community. Whether the old-fashioned people who still held that the steam engine should find no place on our highways wished it or not, the time had come when the traction engine must be recognised and admitted to a place with horses. The prejudice of the quadruped must give way to the interests of men. The horse must be educated to like the road steamer, or at all events to regard it with indifference; and far less difficulty would, we foretold, be incurred in imparting that education than was commonly supposed. "Steam on our highways we must and shall have, and the sooner horses and their owners reconcile themselves to this fact the better for both." With regard to speed, we remarked that though we knew of some makers who still held that "four miles an hour was a sufficiently high speed under any circumstances"—simply because they had up till then confined themselves to the construction of engines which would go no faster—we were of opinion that the steam engine had a far wider field to fill than the handling of heavy loads at four miles per hour. "The conveyance of passengers," we said, "should prove quite as remunerative under suitable conditions as the conveyance of goods." We had no hesitation in saying that the moment engines were permitted to proceed at seven or eight miles an hour, and did it, the chances of accident and the risk of obstruction to ordinary traffic would be reduced by one-half. Moreover, we ridiculed the rule regarding the red flag, saying that it was a dead letter, since the flagman rode on the engine or trailers whenever he could. Logically, we argued, it was just as necessary to have a red flag behind as in front of a steam locomotive, since it was just as often passed from behind as from the front. Besides, we remarked, in towns a flag was superfluous, since "the noise made by the engine, and the rush of a crowd of dirty little boys, is always sufficient notice of the approach of a steam train through a town. The engine and the shouting can always be heard before the red flag can be seen." Can all this be only sixty years ago? Yet a quarter of a century had to go by before that red flag finally disappeared.

Pivots and Jewels.

THE conditions of service for a pivot and jewel bearing are very severe. The area of contact is so small that even with a compass card weighing only a fraction of an ounce the pressure per unit area on the pivot is many tons per square inch. Despite this intense pressure, relative motion of pivot and jewel must be accompanied by minimum friction. There is the further requirement that continued service without deterioration is necessary over considerable periods of time.

The design and manufacture of pivot and jewel bearings which will give efficient service under these stringent conditions presents many problems of considerable theoretical interest, and of great industrial importance. Pivot and jewel bearings are used in many other instruments; for example, voltmeters, electricity meters, watches, &c., which are used in very large numbers and the reliability of which depends on the proper functioning of their pivot and jewel bearings.

An investigation of these problems has been undertaken at the National Physical Laboratory, and an account of the work has just been published—"An Investigation of Problems relating to the Use of Pivots and Jewels in Instruments and Meters," by V. Stott, B.A., F. Inst. P., National Physical Laboratory; collected researches, Paper I., Vol. XXIV., published by H.M.S.O., price 4s. net. The paper consists of fifty-five pages of text and numerous diagrams and plates.

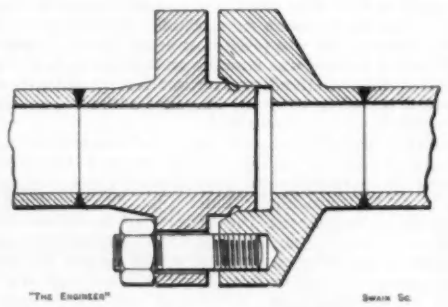
An interesting case of dry corrosion was found in the wear tests, for whenever a steel pivot was rotated in contact with a sapphire jewel in the absence of lubrication, a heavy deposit of rust developed. This rust was actually formed as the pivot rotated, and did not develop in the absence of relative motion between pivot and jewel. The increase in friction during the wear test was largely due to the presence of this rust, which forms on "stainless" steel pivots on rotation exactly as on ordinary steel pivots.

Two important results emerged from the experiments on lubrication. First, it was found that the presence of oil made no appreciable difference to the friction between a new pivot and jewel. This had previously been established by other workers, and, on the basis of this result, it has sometimes been recommended that jewel bearings should be run without lubrication on the grounds that the initial friction is not reduced by the presence of oil and that the oil eventually increases the friction by collecting dirt or becoming resinous. Further experiments were carried out, however, in which a pivot was rotated in contact with a stationary jewel under conditions similar to those existing in an electricity meter. Two identical bearings were used, but one was run dry and the other lubricated. It was found that, whereas the first had a useful life of only half a million revolutions, the lubricated one gave a useful life of fifteen million revolutions. Hence, although lubrication does not increase the initial friction of a pivot and jewel bearing, it does materially increase the useful life of the bearing.

The work so far carried out has opened up the possibility of further lines of research, and it is hoped to continue the investigation.

A HIGH-PRESSURE PIPE JOINT.

THE sketch which we give herewith is reproduced from our contemporary *Power*, and shows the construction of a pipe joint for very high steam pressures and temperatures, which is said to have met with complete success in Czechoslovakia. The arrangement is so obvious in the drawing that it needs no explanation, but it may be



PIPE JOINT FOR HIGH PRESSURES

pointed out that the joint is pulled up so tight that the inner cone is slightly deformed and makes an hermetic seal. It will be noticed that the flanges are welded by the oxy-acetylene blow-pipe to the ends of the pipes. The joint is said to be good for pressures up to 1900 lb. per square inch and temperatures up to 932 deg. Fah.

BRITISH CHEMICAL STANDARD HIGH-DUTY IRON "G."

WE are informed that a new high-duty iron standard is now about to be issued by British Chemical Standards, 3, Wilson-street, Middlesbrough. The analysis of it is as follows:—

	Per cent.
Total carbon	2·68
Graphite	1·82
Combined carbon	0·86
Silicon	1·30
Manganese	0·410
Sulphur	0·125
Phosphorus	0·45

This sample has been made specially to meet the need for an iron low in total carbon, moderately low in phosphorus and fairly high in sulphur content. Great care has been taken to prepare fine turnings free from dust so as to make it as homogeneous as possible, and particularly with a view to its use for the determination of total carbon and graphite. It is of interest to note that, in order to prevent deterioration, the bulk of the turnings are being stored in an atmosphere of dry nitrogen.

In accordance with the usual practice, iron "G" has been standardised by a number of chemists representing manufacturers of refined iron, makers and users of high-duty castings, and by independent analysis. Unusually full notes on the methods of analysis used are given on the certificate of analyses issued with each bottle. By using British Chemical Standard irons "A," "B," "G," and "D2," either separately or in conjunction, standards which cover all the usual requirements of ordinary cast iron are now available.

THE GENERATION OF ELECTRICITY IN GREAT BRITAIN.

WITH the exception that the latest analyses and summaries of the returns made to the Electricity Commissioners of the units generated and fuel consumed at generating stations cover the calendar year ending December 31st, 1930, instead of the financial year, they follow the general form of those previously issued. The alteration in the period covered has been made with a view to facilitating comparison with the statistics of other countries, and also because the working arrangements between the owners of selected generating stations and the Central Electricity Board will be based on the calendar year. As on previous occasions, a composite station containing steam plant and oil engines has been classified in accordance with the type of plant by which the major portion of the output was generated, and in arriving at the average consumption of fuel per unit generated at such stations and also at any other station where more than one class of fuel was consumed, the actual fuel consumption in each case has been converted, on the basis of the average calorific values of the fuels employed, into an equivalent tonnage of the class of fuel from which the largest portion of the output of the station was obtained.

Returns were received in respect of 559 generating stations, a decrease of nine from the number included in the last return for the year ending March 31st, 1930, the difference being accounted for by the permanent closing of twenty-three stations before January 1st, 1930, by the putting into commission of three new stations and four existing standby stations during the year, and by the inclusion in the return of seven other existing stations which had previously been operated on a non-statutory basis, but which became part of authorised undertakings during the year. The total number of units generated at the 559 stations during 1930 was 12,332,949,844, an increase of 3·1 per cent. on the figures for 1929–30, and the total amount of coal, coke and fuel consumed was 9,996,708 tons, or a decrease of 1·42 per cent. Excluding the Guernsey station, the 558 stations which fall within the area groupings generated 12,329,575,309 units, and consumed 9,995,575 tons of coal, coke and fuel oil during the year. Of the steam stations, the Kearsley station of the Lancashire Electric Power Company shows the best thermal efficiency, namely, 23·84, its load factor, based on 8760 hours, being 42·3 per cent., and its output 129,624,646 units. The Padiham station, which generated 33,516,106 units, and which had a load factor, based on the running hours, of 56·8 per cent., showed a thermal efficiency of 19·39 per cent. The Barton station of the Manchester Corporation generated 402,949,300 units, and had a thermal efficiency of 22·23 per cent., its load factor being 41·7 per cent. The thermal efficiency of the Barking station, which generated 543,354,400 units, was 23·02 per cent., with a load factor of 37·2 per cent.

HALF-YEARLY OUTPUT OF IRON AND STEEL.

THE monthly report of the National Federation of Iron and Steel Manufacturers states that the number of blast-furnaces in operation at the end of June was seventy-six, a net decrease of four since the beginning of the month, five furnaces having been damped down, one blown out and two furnaces having resumed operations.

The production of pig iron amounted to 323,800 tons, compared with 346,500 tons in May and 563,200 tons in June, 1930. The production included 80,800 tons of hematite, 110,700 tons of basic, 100,200 tons of foundry, and 17,400 tons of forge pig iron. The June output of steel ingots and castings amounted to 428,900 tons, compared with 435,100 tons in May and 600,100 tons in June, 1930.

The following table shows the average monthly production of pig iron and steel ingots and castings in 1913, 1920, 1928 to 1930, and the production in each month since June, 1930:—

	Pig iron. Tons.	Steel ingots and castings. Tons.
1913, monthly average	855,000	638,600
1920, " "	669,500	755,600
1928, " "	550,800	710,100
1929, " "	632,400	803,000
1930, " "	516,400	608,200
1930, June	563,200	600,100
July	486,100	621,400
August	416,700	451,300
September	425,000	580,600
October	415,000	512,500
November	384,100	433,800
December	349,800	337,200
1931, January	337,200	402,200
February	318,200	486,400
March	357,100	500,100
April	323,200	397,400
May	346,500	435,100
June	323,800	428,900

CHICAGO'S UNDERGROUND RAILWAY.

OFFICIAL approval of plans for a subway line in Chicago seems likely to result in the construction of a local transportation facility that has been the subject of planning and controversy for some years. Its purpose is to form a direct route connecting the elevated railways north and south of the business district, to replace the circuitous route around the elevated loop line which encircles that district. It will be a four-track shallow-depth structure, 3½ miles long, having its roof about 3ft. below the street surface. There will be five rows of steel columns supporting roof beams and a concrete deck, the two side rows being enclosed in the concrete walls, while the floor will be a heavy slab of reinforced concrete. The columns are spaced 13ft. between centres transversely and 5½ft. longitudinally, except that at stations the spacing will be 16½ft. The clear headway above rail level is to be 15½ft., and at stations there will be a concourse 10ft. high between the roof and the street. From this concourse there will be stairs to the platforms and the street, and also entrances to the basement floors of large shops. To pass under the Chicago River the line will descend to four steel tubes of 18ft. diameter, cased and lined with concrete. These tubes are to be built on shore, launched, towed into position, and sunk in dredged trenches, as was done some years ago with the La Salle-street tunnel for the tramway lines. The subway, occupying the full width of State-street, will be built by the cut-and-cover method. One of the tunnels of the narrow-gauge underground goods railway occupies this street, but is at a depth of about 40ft. and will not affect the upper structure. Most of the work will be in clay of varying degrees of softness. The total cost is estimated at £9,000,000, and a curious feature is that about £6,000,000 will be paid by adjacent property owners on the theory of special benefit to them.

Railway and Road Matters.

THE fifth annual report of the London and Home Counties Traffic Advisory Committee has been issued as a Stationery Office publication, price 2s. 6d. In view of the unusual interest now being taken in London passenger transport, it may be noted that the report covers, among other subjects, the constitution of the Committee; the street signals for Oxford-street; the number of passengers carried by the "Underground" between 1925 and 1929, and a statement as to street accidents.

DURING the twelve months ended March 31st last, the Great Western Railway Company's Suggestions Committee considered 2342 suggestions from the company's staff, of which 402, or 17 per cent., were recommended for adoption. Besides proposals in relation to the obtaining and retention of traffic, many useful ideas were received in connection with engineering matters, including locomotive fittings, mechanical appliances, permanent way, signalling, shop equipment, tools, and so forth.

IN our last two annual articles on Railways, reference in connection with the Southern Railway has been made to an improved station at Hastings. That work has now been opened. Two island platforms, each 650ft. long, have been provided in place of only one through road and three bay lines, whilst an outstanding feature is the new public approach and the station buildings, wherein is a fine circular booking concourse, off which are the booking-office, refreshment room, tea-room, bookstall and entrance to the station—all convenient of access.

IT is often contended by those who would like to see the privately owned wagon eliminated that it is not as efficiently maintained as the railway-owned. Our reply to that assertion has always been that the contrary is the case. Corroboration of that is to be found in the Railway Accident Returns for 1930. To appreciate the position rightly, it must first be remembered that the railway companies own just over one-half the total number—700,000—as against 650,000 privately owned. Yet, out of 6676 cases of failures of couplings, the number of privately owned wagons was 2537.

A FORMAL statement was issued by the chairman and president of the Canadian Pacific Railway Company in Montreal on June 1st, to the effect that Mr. John Johnson, chief superintendent engineer of the Canadian Pacific Steamships, has been appointed "chief engineer of steamship services" for the railway and steamship companies. His office will, as hitherto, be at 8, Waterloo-place, London. Mr. Johnson's new post embraces responsibilities in connection with design and construction of tonnage for the Canadian Pacific Railway Company, together with other duties pertaining to the company's steamship services.

THE Ministry of Transport railway statistics for April have recently been issued as a Stationary Office publication, price 2s. 6d. They show that, compared with April, 1930, the number of passenger journeys decreased by 5·4 per cent., whilst the decrease in receipts from passengers was as high as 11·1 per cent. In view of the one-time transfer of passengers from full fares to reduced fares, it is significant that the decrease in the number of the latter is nearly as great as the decrease in the number of full-fare passengers. Some satisfaction may be found in the fact that coaching miles fell by 1·4 per cent. The tonnage of freight was 11·5 per cent. less and freight receipts 8·3 per cent. Freight train mileage was reduced by 7 per cent.

DURING the three months ended December 31st last the Assistant Inspecting Officers of the Ministry of Transport held 53 inquiries into the more serious accidents to railway servants, of which 15 were fatal cases, and in one of the latter two men were killed. The causes assigned for the 15 accidents were: Misadventure in 8, want of care in 6, including the double fatality and no look-out man in 1. An unusual feature of the quarter under review was that three men were killed whilst engaged in fog-signalling, and, moreover, the wife of a fogman was killed in a fog when taking food to him. During the year the two Assistant Inspecting Officers held 180 inquiries, of which 58 related to fatal accidents. In 30 of the latter cases the cause given was misadventure, in 20 it was want of care, and in 6 there was no look-out man.

IN view of the electrification recently of the Manchester South Junction and Altrincham Railway, it is significant to note that in the Traffic Court at Manchester on July 6th, counsel for the railway companies, in opposing an application for an omnibus service between Manchester and Flixton, said that if the present competition from road traffic was unrestricted and undiminished, there was a grave danger that all future developments on the railways so far as electrification was concerned would be practically impossible. It was not merely that something must be done to prevent additional services being put on the route, but it was that the services already in operation were such that they prevented future development. The result was that unless it was restricted electrical development would be put out of all possibility for the future.

WE have been led by an article in the June issue of the *London and North-Eastern Railway Magazine* to take an interest in the amounts spent by British railways on lubricants used in locomotive running. Reference to the Railway Returns for 1929 shows that the Southern, Great Western, London, Midland and Scottish and the London and North-Eastern paid away, respectively, £31,455, £46,563, £118,113, and £89,622. Reference, then, to the statistical return CXIV. gives the number of pints of lubricating oil used per 100 miles, whilst a comparison between the returns for, say, the last five years, shows a remarkable uniformity of consumption by each company, year by year. So much is that so that we think it will be of interest to have the figures for each of the five years 1925–1929. The figures for passenger working were: Southern, 6·72, 6·99, 6·97, 6·83, 6·89; Great Western, 6·18, 6·30, 6·40, 6·45, 6·52; L.M.S., 6·42, 6·79, 6·63, 6·30, 6·41; L.N.E., 7·91, 7·75, 7·26, 7·23, 7·18. For freight working the corresponding figures were: Southern, 7·97, 8·36, 8·20, 7·68, 7·62; G.W., 7·10, 7·02, 7·21, 7·10, 7·13; L.M.S., 6·71, 6·72, 6·77, 6·52, 6·59½; L.N.E., 8·20, 7·86, 7·67, 7·50, 7·37.

Notes and Memoranda.

A BRIDGE of 1806ft. length in 86ft. spans is being built in California across the Santa Clara River, on foundations supported by steel piles. The piles are of 8in. H section steel and they aggregate 19,100ft. in length.

THE pressure of traffic on the transportation facilities in San Francisco has become so great during the "rush hours" that some large offices have decided to alter their working hours by half-an-hour. The number of employees concerned appears to be about ten thousand.

THERE is an advertisement in an American engineering journal which announces an iron culvert for drainage purposes. An instance is given of a culvert which has been in service for nineteen years and is in "perfect condition to-day." The metal is described as being iron of a purity of 99·9 per cent. "alloyed with the right amount of copper."

IN the construction of a thirty-storey building in Kansas some unusually heavy girders have been employed. It was desired to have one floor free of columns, so the structure above that point is carried on these girders. They are of silicon steel and measure 70ft. span by 14ft. deep. They carry twenty-five storeys of the building, and it is said that the use of silicon steel has saved 7½ per cent. in the cost as compared with plain carbon steel.

A NUMBER of experiments have been carried out with the object of finding a good type of door for closing the openings of kilns used for the artificial seasoning of timber, and one of the best forms, according to the British Aluminium Company, is a door made of two sheets of No. 20 gauge aluminium sheet with 1in. of intervening insulating material. Such a door is said to be as good for the purpose as 13in. of brick wall, and is, obviously, much lighter, while it has a long life.

To the Greek class at the University of Pittsburgh Professor H. S. Scribner recently demonstrated the use of a new device developed in the Westinghouse research laboratories for depicting on a screen a record of the tones of the human voice and any other sounds. Professor Scribner said that the apparatus was expected to be helpful in teaching Greek, Latin and Sanskrit, and also modern languages. It comprises an ordinary microphone, the new cathode ray oscilloscope developed by Mr. Osbon, and batteries to supply the necessary energy.

UNTIL quite recently church bells which had cracked had to be melted down and recast before they could be rung properly, and, as a consequence, many fine specimens of old craftsmanship have lost their identity. Now, however, it is possible to mend such bells as they are, and such an operation has just been carried out by Barimar Ltd. on one of the bells of Shelton Church, in Bedfordshire, which has been silent for at least 150 years. The bell is nearly 300 years old and was founded by Hugh Watts, of Leicester, in 1634, but had a crack 3ft. long in the crown. This crack has now been successfully mended by the welding process and the bell can be used again.

ALLOYS of lead and thallium are somewhat unusual, in that they have higher melting points than either of the component metals; they are used in rather small quantities in special types of electrical fuses. An alloy containing 10 per cent. thallium, 20 per cent. tin, and 70 per cent. lead is resistant to the corrosive action of mixtures of sulphuric, nitric, and hydrochloric acids. This alloy has been recommended for use as an anode for the electrolytic deposition of copper, since its corrosion is less than one-fifth that of lead alone. Experiments indicate that the addition of thallium to lead-base alloys markedly improves their resistance to deformation.

WE hear that the Oerlikon Company has recently completed the installation of 200,000-volt testing plant at the works of the Société d'Exploitation des Cables Electriques, Systeme Berthoud, Borel et Cie., at Annonay, Switzerland. The plant will be used for carrying out continuous-pressure tests of drums of cables and produces the necessary pressure by means of a single transformer with an earthed pole, the secondary winding of which is so arranged that it can be connected either in series or in parallel to obtain a full output of 1200 kVA at either 100,000 or 200,000 volts. The alternator used with the set has a capacity of 360 kVA and is directly coupled to a synchronous induction motor having an output of 110 kW, the machine being also used for the compensation of the wattless load of the internal distribution system of the works. The arrangement of the installation was the subject of special consideration in order to ensure ready access to the plant as well as the ease of its control and supervision. The transformer is placed in a pit so that its cover lies flush with the floor of the cable room. The control gear and instruments are all grouped on a switch desk and a panel in the control room, below which are placed three reactance coils for the compensation of the capacity current, one of the coils being adjustable.

THE American Bureau of Standards has been studying the penetration of water into brickwork. The results show that when the interior walls of brick buildings become wet during a rain it is likely that water has entered through open spaces between brick and mortar rather than directly through these solid materials. Such openings may be produced either by poor workmanship or by shrinkage of mortar. If there are no openings of this sort the probability of penetration by water through solid 8in. brick walls is exceedingly remote under normal climatic conditions and if proper precautions in design have been taken. One necessary precaution is to avoid plastering directly on the brick in an 8in. wall, and that may be accomplished either by furring the wall or by the use of metal ties in place of header bricks. The time required for water to travel through a brick, thence through a mortar joint, thence through another brick is far greater than the time taken for water to penetrate the two bricks and the mortar joint when those materials are tested separately and out of contact with one another. Probably one reason for this is the fact that the pores in one material do not communicate directly with those in the other. It is also known that a brick must become highly saturated before it transmits water to another material. This degree of saturation is not attained when the brick is merely wetted through.

Miscellanea.

THE Government of British Columbia is organising an extensive re-afforestation scheme. An area of 500,000 acres near Harrison Lake and another, which already has some 300 million feet of standing timber, at the head of Powell Lake, are to be planted. It is intended to plant 800,000 seedlings of Douglas fir during 1932–3.

THE river Esla, in Spain, is being dammed immediately above its conjunction with the Duero. With topographical conditions ideal, a dam 200ft. high and 800ft. long is being constructed with a view to impounding water over an area of nearly 60 square miles. Six turbines, each of 22,000 H.P. will eventually be installed, and it is expected that even in drought years the plant will maintain a daily output of 360,000,000 kWh.

THE iron ore deposits in the Kursk region of Russia, about 500 miles to the south of Moscow, are, according to the *Iron and Coal Trades Review*, said to be the richest in the world. The deposits are being investigated by a commission of the Academy of Science, headed by Ivan Gubkin, who has estimated the total reserve of iron ore in the region at about equal to the total world reserves outside the U.S.S.R.

ACCORDING to the *Koelner Tageblatt*, Constantin J. Choremi, who is known as the Egyptian Cotton King, is paying £500,000 to the Heidelberg chemist inventor, Caspar Schmitt, for the patent rights in Egypt, the Sudan and the Balkan States, in connection with his new process for making cotton seed meal into nutriment fit for human consumption. A factory for manufacturing the meal has already been started in Alexandria.

THE Chinese Ministry of Industries, in an order to Dr. Wu Chien, Director of the Hankow Bureau for the Testing and Inspection of Commercial Commodities, instructs that negotiations be conducted with the authorities of the Hanyehping Iron and Coal Mines for the resumption of operation of the mines. The Hanyehping Company has practically been disorganised since 1928. The Pinghsiang coal mines have been taken over by the Kiangsi Provincial Government, while the Hangyang and Tayeh Ironworks remain idle. Only the Tayeh iron mine is still being worked.

ACCORDING to finally revised figures issued by the Dominion Bureau of Statistics at Ottawa, 68,116 fine ounces of platinum, palladium, rhodium and other metals valued at 2,439,128 dollars, were produced from Canadian mineral ores in 1930, as compared with the 1929 total of 29,837 fine ounces worth 1,656,045 dollars. Production of Canadian platinum metals comes almost wholly from the copper-nickel sulphide ores of the Sudbury area, and the International Nickel Company is now operating the refinery at Acton, England, which was recently described in THE ENGINEER.

THE new 12in. pipe line of the Western Gas Company, from El Paso, Texas, to Douglas and Bisbee, Ariz., and Cananea, Sonora, Mex., was, says *Power*, put into service June 8th. Construction of this 300-mile pipe line was started in February and completed the latter part of May, two months ahead of the contracted construction schedule. The completed line was successfully tested by the 24-hour pressure drop method at 750 lb. per square inch. The line will be operated under a pressure varying from 300 lb. to 600 lb. per square inch. The construction of this line cost 6,000,000 dollars.

A GAS company of Ohio has adopted an ingenious plan for maintaining the supply of gas to its consumers while the gas mains had to be laid off for alterations. Whilst changing over from the old to the new lines, it was necessary to shut off the gas supply of a town. To prevent the inconvenience which would be caused by a complete stoppage, the company employed two 35,000 cubic foot capacity racing balloons, filled them with illuminating gas in a neighbouring meadow, connected them with a portable compressor, and then pumped the gas through from them into the distribution mains.

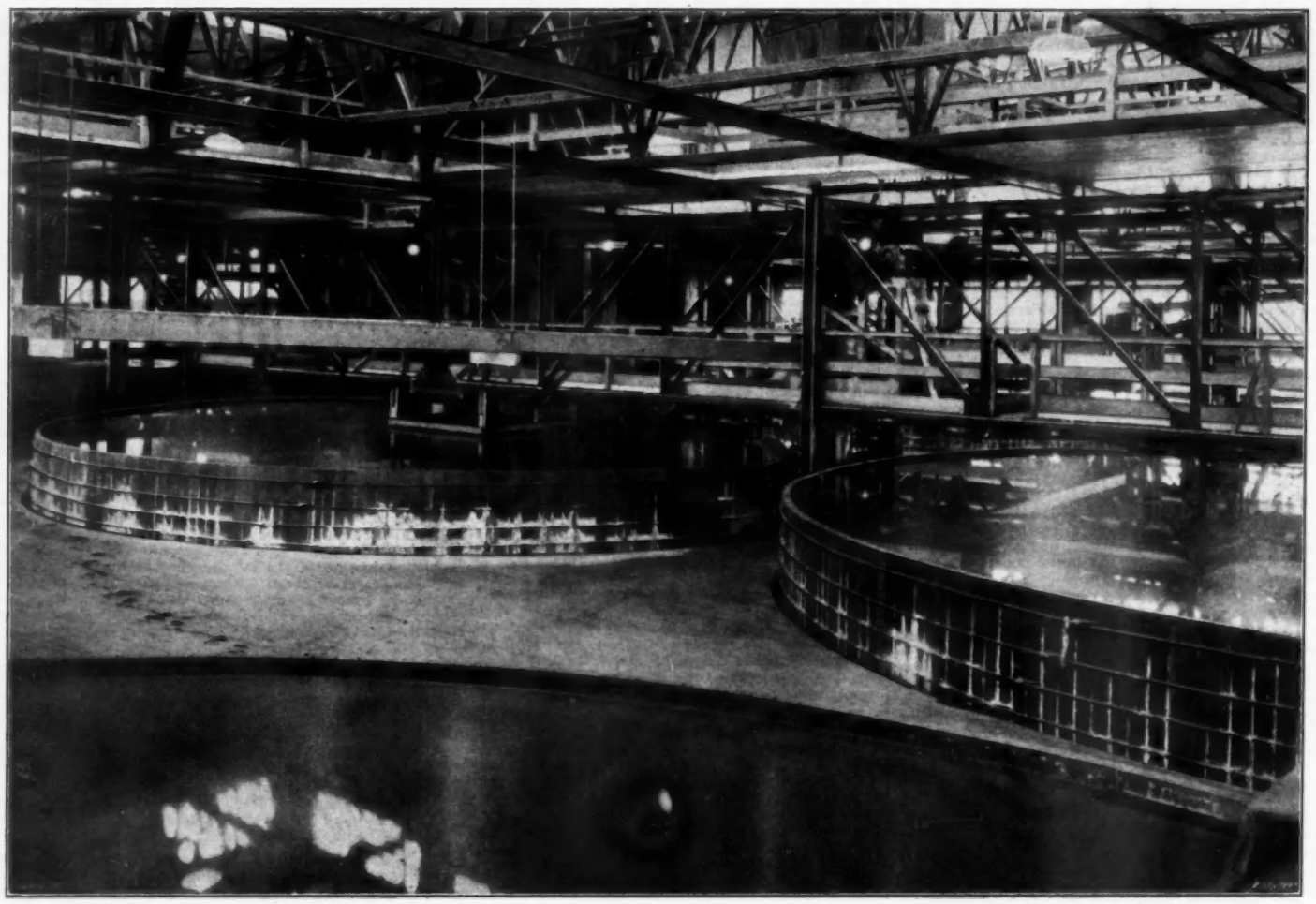
FOR the convenience of highway authorities, the Ministry of Transport has now provided at the National Physical Laboratory apparatus required for making tests on concrete paving slabs, and the Director of the Laboratory has arranged to make the complete set of tests, in duplicate, on payment of a fee of six guineas. Applications for tests to be made should be addressed to the Assistant Secretary, Roads Department, Research Branch, Ministry of Transport, 7, Whitehall-gardens, London, S.W. 1, who will, in the case of approved applications, give the necessary instructions regarding the despatch of the test pieces and the payment of the fee for making the tests.

NEWS from the Kiangsu Province of China states that new coal deposits have been discovered on the Chiawan coalfield at Chiachiawan, near Hsuchow. The seams, which had been worked by three shafts, appear to have been exhausted, but another deposit has been found. It consists of three seams, the top being 2ft. thick, the middle 4ft., and the bottom 6ft. Three shafts, between 30ft. and 40ft. in diameter, have been sunk for a distance of 300ft., and about 200 tons of coal are being brought to the surface daily. With the introduction of electric mining machinery it is hoped to increase the output very considerably, and selling agencies are being established at points along the Tientsin-Pukow and Nanking-Shanghai railways with a view to finding new markets for this coal.

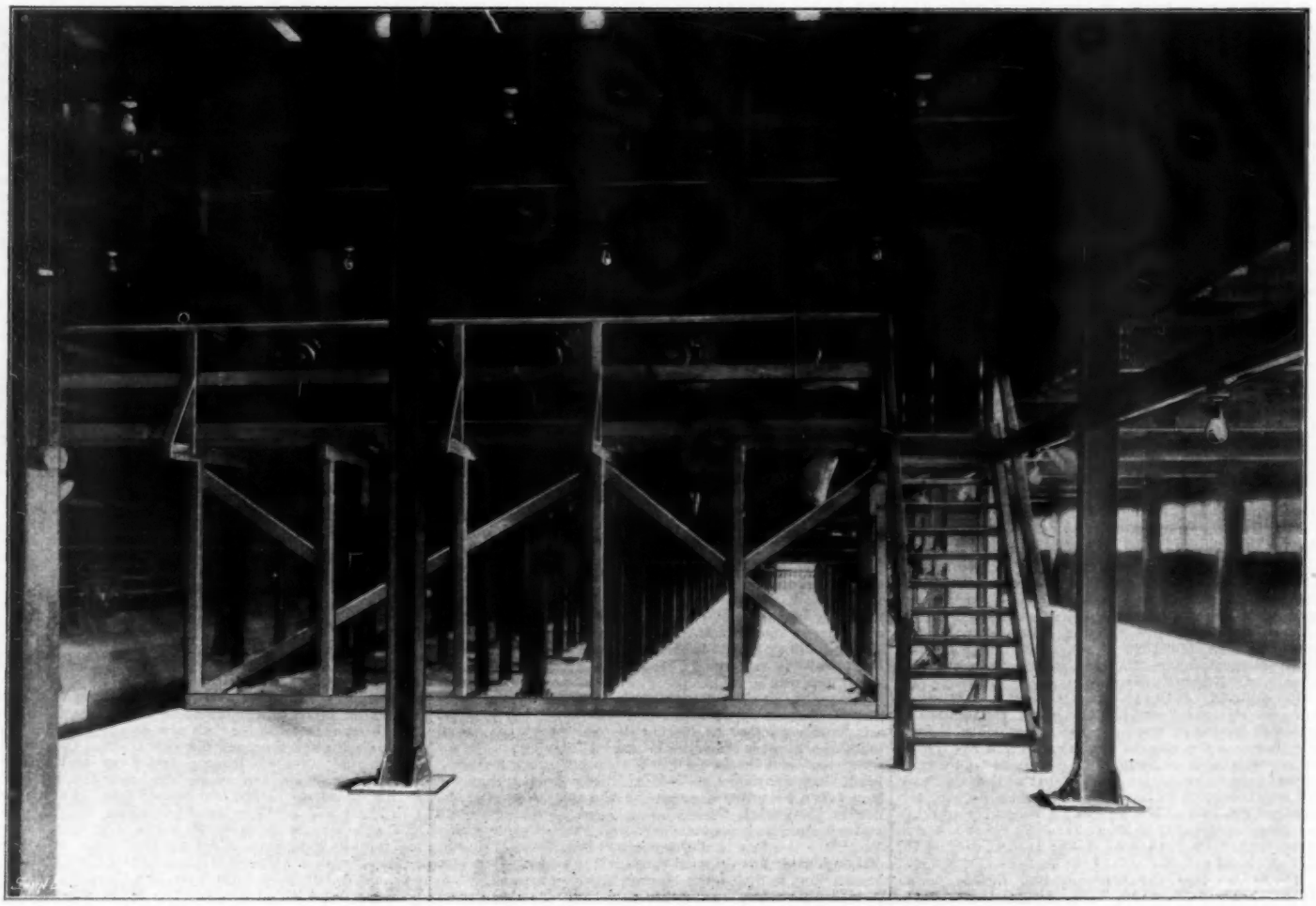
THE British Industries Fair buildings at Castle Bromwich, Birmingham, are to be extended at a cost of £20,000 in order to accommodate the new sections which have been announced for next year and to meet increasing demands for space among old exhibitors. Old buildings covering 1½ acres are being pulled down and three new roofs, covering an acre each, will bring the total inside letting space up to 250,000 square feet. For the next Fair there will be 13 acres of exhibition buildings in all at Castle Bromwich, with 30 acres of ground available for further extensions. All the buildings at Olympia London, with a total exhibiting area of 300,000 square feet, are to be used for the Fair, and there is expected to be some difficulty in meeting the applications for space which have now been invited by the Department of Overseas Trade.

ZINC RECOVERY WORKS AT TRAIL, BRITISH COLUMBIA

(*For description see page 60.*)



OXIDE LEACHING PLANT



DUST COLLECTORS IN SLAG FUMING PLANT

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OF AMERICA	New York, N.Y., and all Branches
* $16·40	Entered as second-class matter at the Post Office,
† $15·25	New York, N.Y., December 12th, 1896, under the
	Act of March 3rd, 1879 (Section 397, P.L. & R.)

* *Thick Paper.* † *Thin Paper.*

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THE ENGINEER.

VOL. CLII. No. 3940

JULY 17, 1931.

Locomotive Testing Plants.

MR. GRESLEY'S paper at the Cambridge meeting of the Institution of Mechanical Engineers carries his advocacy of a British locomotive laboratory a step further, for it includes particulars of the plant proposed by Sir Alfred Ewing's Committee which have not hitherto been given. We may remind our readers that that Committee is composed of a very representative group of railwaymen and scientists, and that its unanimous report to the Department of Scientific and Industrial Research was favourably received—see THE ENGINEER of March 6th and 13th last. Despite a certain amount of doubt as to the value of such stations which was expressed at the Cambridge meeting, we still hold, and we are confident that most railwaymen take the same view, that valuable researches could be carried out with a plant of the kind, and that no other method of testing locomotives, and the details of locomotives, can give equal assurance of constant conditions, which is an accepted essential of scientific investigation. It is no secret that the Great Western Railway is studying electric locomotives, and it was, we presume, that fact which led Mr. Stanier to express doubt as to the wisdom of expending money on what he regarded as a "steam" locomotive testing plant. But even if in the course of years electrification of British railways should take place, steam and internal combustion locomotives for overseas will have to be built, and it is by no means impossible that even the electric locomotive could profit from scientific examination in a research station. The Committee has always kept in view the probability that novel forms of locomotive would from time to time present themselves, and the plant is so designed that it may be used for any vehicle which propels itself by rotation of its wheels on rails.

Interest in the paper centres around the design for a testing plant which differs in two material respects from the American, German, and Great Western plants and from that which is being constructed at Vitry by the French railways. The difference consists in the provision (1) of an artificial wind to simulate the forward motion of the engine on the rails, and (2) the coupling together of all the dynamometer rollers by bevel gears and shafting. This double provision must, inevitably, greatly increase the cost of the station, and the question of the advantages to be derived from it needs, therefore, very earnest consideration. The cross section of the proposed wind tunnel measures 25ft. by 30ft. and it is estimated that fans consuming up to 2000 H.P. will be needed to provide a wind of 60 miles per hour. The geared arrangement of the dynamometer rollers has been adopted in order to facilitate the employment of the energy developed by the engine under test for driving the fans. Were there no tunnel it is probable that the Committee would have been satisfied with independent brakes as in existing plants. Since, therefore, it may be said that the design of the station has been controlled largely by the desire to include a wind tunnel, it is necessary to ask what particular advantages will be derived from that expensive provision. It would, Mr. Gresley tells us, "reproduce the effect of running conditions on the rate of combustion," and "would also more closely indicate the output of the locomotive under running conditions, in that the resistance due to wind pressure would have to be overcome by the engine under test, and consequently the pull recorded on the draw-bar would be almost exactly the same as would be given if the engine were hauling a train." We observe that Mr. Gresley, himself, regards the wind tunnel "as in the nature of a refinement rather than as an essential feature." In that view of it we are, at present, in agreement with him and suggest that the Committee should reconsider the question before advancing a design the progress of which may be hampered by its costliness. Let us ask ourselves what the wind tunnel can do. It can add to the head resistance of the locomotive. But there is no particular advantage in applying that resistance by a costly current of air when the equivalent can be provided by increasing the load on the draw-bar. Moreover, to simulate the actual conditions the engine would have to be attached to a train also subjected to the current of air—a quite impossible proposition. But at best the wind tunnel can only imitate one condition, namely, that of an engine alone—even without its tender—running through still air. As far as the resistance is concerned, we cannot see that this is of any value. If desired, a suitable factor might be calculated from an accepted formula and an additional load, as we have already suggested, be placed upon the draw-bar. We agree that combustion conditions may be simulated in a wind tunnel, and note that in his reply to the discussion Mr. Gresley stressed this aspect. But the simulation will be only approximate and only, once more, for an engine running in still air. We say only approximate, because it will not be easy to copy the effect of the "road" in the test plant, and the road itself affects the current of air to the ashpan, for the sleepers must inevitably cause eddies and turbulence. Now, in the plant the engine will be at rest relatively to the sleepers, if any, and the ashpan damper might happen to fall just at the crest of a "standing wave" or other abnormality in the air current, whereas in a travelling engine the conditions will, for obvious reasons, be quite different. It may, we admit, be desirable to provide a high-speed air current around the ashpan, but we suggest that a cheaper and simpler method might be sought. For such reasons as these we are, in the absence of contrary arguments, disposed to regard the provision of the wind tunnel as an unnecessary expense. There are certain facts that can be best found out in a wind tunnel, but there is every reason for believing that the research could be made as well on miniature models as on a full-scale locomotive. But if the wind tunnel is in the nature of an unessential refinement which can be given up, then the braking equipment proposed by the Committee could also be revised, for the two hang together. That it would be an expensive arrangement can hardly be doubted, and we are not quite satisfied that it would be perfect mechanically. We do not question the ability of gear manufacturers to produce the bevel wheels with sufficient accuracy, but we fear that the torque in the shafting might introduce irregularities which under certain conditions would be serious. The use of independent brakes avoids that possibility and has proved fairly satisfactory. It has, however, one defect, which Mr. Gresley very rightly points out and which the geared arrangement overcomes. The latter would, we agree, more nearly represent actual track conditions if it were possible to avoid all torque of the shafts and every trace of irregularity in the gears. If that ideal condition cannot be secured save at an excessive capital and maintenance cost, then it *may* prove better to

follow experience and use independent braking units.

This criticism of the provisional design, which, we may say, reflects the views expressed by several of the speakers in the discussion of Mr. Gresley's paper, does not in any way diminish the anticipated value of a locomotive laboratory, and, in fact, brings the realisation of that desideratum nearer by suggesting means for the reduction of expenditure. No one pretends that a testing plant can ever precisely imitate road conditions, and we submit that it is not necessary that it should do so. What it can do is to give constant conditions and thereby enable the value of modifications, relatively to each other, to be measured. It is rarely, indeed, that any tests of any kind can be carried out under arrangements which exactly simulate those that have to be met in ordinary work, but no one says, nowadays, that for that reason they are valueless. It is well known, to take a single example, that tank experiments differ materially from sea conditions, but their value in the design of ships cannot be questioned. In the same way a locomotive testing plant must be operated under conditions which are not in all respects like those presented on the road in daily service; yet it enables researches to be carried out, and measurements to be made, which are practically impossible upon the railway itself.

The Efficiency of Steam Nozzles.

IT would appear to be desirable to restate the grounds for the criticism which has appeared in our columns concerning the experimental methods employed by the Steam Nozzles Research Committee of the Institution of Mechanical Engineers. Those who have sought to defend the Committee's methods have either misunderstood our criticism or have tried to turn it aside by introducing irrelevant subjects. The Committee, whatever its apologists may say to the contrary, defined the efficiency of a nozzle as "the relation between the energy due to the actual velocity of the steam as it leaves the nozzle and the energy theoretically due to the adiabatic expansion of the steam." This definition, it will be noted, does not make or require any reference to the action of the steam on the blades after it leaves the nozzle. It should, therefore, be clearly understood that Mr. Oakden, in his defence of the Committee's methods, relies for the success of that defence upon an essential departure from the Committee's definition of efficiency. In another quarter the Committee's methods have been defended in a similar manner, namely, by casting aside its carefully worded definition of the quantity which it set out to measure. We are now told that the Committee's real object was to measure the actual momentum of the jet and to compare it with the theoretical momentum which it should possess by virtue of the heat drop. The ratio of these two quantities, it is stated, may legitimately be called the efficiency of the nozzle, the argument being that the duty of a steam turbine nozzle is to produce momentum, not kinetic energy. The manner in which the Committee's definition of nozzle efficiency has been rejected on after thought is in this case particularly striking.

From the nature of these two defences the reader might think that our criticism concerns the Committee's method of defining nozzle efficiency. It does not, or at least does so only incidentally. The Committee proposed to measure the effiicency of steam nozzles. It defined that efficiency as the ratio of two quantities of energy, the ratio of the actual to the theoretical kinetic energy of the jet. Our criticism concerns only the numerator of this ratio. It would apply equally well whatever the denominator were, for it turns solely upon the method adopted by the Committee for determining the actual kinetic energy of the jet. That method consisted, in brief, in directing the steam leaving the nozzle on to a plate and weighing its reaction, and in condensing and weighing the steam over a given period in order to determine its mass rate of efflux. The reaction of the steam on the plate being equal to the momentum of the jet and the mass rate of efflux being known, these two measurements gave the experimenters a means of calculating the velocity of efflux of the jet. Knowing the velocity and the mass separately, they were then in a position, according to their underlying argument, to calculate the kinetic energy of the jet, the numerator in the adopted expression for the nozzle efficiency. Our criticism of this procedure hinges upon the fact that the velocity of the steam is not uniform across the area of the jet. It is high towards the centre and low towards the sides. That being so, the impact on the pressure plate combined with the mass rate of efflux provide the data for determining the average velocity of efflux. This average velocity may legitimately be employed to calculate—if we did not already know it—the momentum of the jet or any other property or factor of it involving the first power of the velocity. It is a "first power" average and is available for all "first power" calculations. It is not available for calculating the kinetic energy of the jet because the kinetic energy expression involves the second power of the velocity. Its employment for that purpose may introduce a discrepancy of unknown and, possibly, serious amount. The fact cannot be denied that the pressure plate type of apparatus is incapable of measuring the kinetic energy of a jet, and therefore is not admissible as a means of determining nozzle efficiencies so long as the definition of efficiency adopted involves as one of its factors the kinetic energy of the jet. In this fact we see the origin of the attempts now being made to modify or cast aside the Committee's definition of efficiency and to introduce an entirely different definition adapted to the limitations of the pressure plate type of apparatus. A secondary point in our criticism related to the possibility that the density of the jet might vary from point to point across its section equally with the velocity. It is a question which can only be solved by experiment conducted under the same conditions as those prevailing at the time of the efficiency tests. We have never asserted that the density of the fluid definitely does vary across the section nor have we expressed a definite opinion as to whether such a variation, if it existed, would increase or diminish the discrepancy arising from the variation of the velocity. We merely sought some assurance that the Committee had not overlooked this additional possibility and that it had satisfied itself that it did not exist or that its effect was negligible. So far the only practical evidence adduced to support the view that the density is uniform across the jet turns upon the observed absence of standing waves on the surface of the jet issuing from a particular form of nozzle employed in Pelton wheels. The fact that in one case steam is being dealt with and in the other water is apparently of so little importance as not to require mention.

So far, as we have shown, our criticism of the Committee's methods has been met by an attack on the Committee's definition of efficiency. It is not our duty to defend that definition. We are perfectly willing that it should be modified or even completely changed. It stands, however, as we have given it, throughout the Committee's six reports. It is unequivocally drawn on an energy basis and numerous references might be quoted to show that the Committee definitely and uniformly regarded nozzle efficiency as a quantity involving the comparison of energies. The energy basis is without doubt the most fundamental and general one on which to assess the efficiency of nozzles. It has the not unimportant merit that it provides a measure applicable to all forms of nozzle, whether for steam or water or other fluid and whether used in turbines or otherwise. If, however, the momentum of the jet rather than its kinetic energy is the feature of it with which steam turbine designers are primarily concerned, there is no reason why, for steam turbine purposes, the efficiency of a nozzle should not be defined as the ratio of the actual to the theoretical momentum of the jet. In that event the efficiency of the nozzle becomes identical with the velocity coefficient. But is it quite certain that momentum rather than kinetic energy is the real factor of interest to steam turbine designers? One apologist assures us that it is. Another, Mr. Oakden, assures us that it is not, and "proves" mathematically that the real factor of interest is the square of the velocity coefficient. The only safe conclusion to express at the moment would appear to be that the flow of fluids, and particularly steam, through nozzles presents many complex interrelated phenomena concerning which, in spite of the Committee's work, we still know very little.

Cambridge as a Place of Education.*

By Professor C. E. INGLIS, M.A., LL.D., F.R.S.

IN view of the fact that many of this audience may be strangers to Cambridge, I thought it would not be out of place to explain in a few words how this particular town of all others in the country came to be singled out at an early date as a centre for learning and education.

A widely accepted popular belief prevails to the effect that the colleges of Oxford and Cambridge developed out of institutions of a monastic character, in which the pursuit of knowledge had outrun the interest in religious observances. This popular theory is entirely erroneous. The colleges of Cambridge owe little or nothing to the monasteries, and it is nearer to the mark to say that they were brought into existence to counteract and to break down an educational monopoly. They were the result of a reaction against the system by which the acquisition and dissemination of knowledge had become the exclusive privilege of certain religious orders. They were brought into existence to meet the needs of those who wished for knowledge without the obligation of conforming to the mode of life prescribed by monastic rules and regulations. This idea of emancipation is well indicated by the fact that, although in the early days there was no objection to monks attending lectures or taking a university degree, they were not on any account permitted to participate in the life or management of the colleges.

In college architecture a reaction against monastic influence is also noticeable. Instead of following the lay-out evolved to suit the monastic life, the colleges were more inclined to take as their model the quadrangular country houses of the fourteenth century, which were replacing the severely utilitarian strongholds of an earlier period. Thus the communal dormitory never appeared in college buildings, and cloisters, though sometimes introduced, were evidently not regarded as a necessity.

So far I have been speaking only of the colleges, the first of which, Peterhouse, was founded in 1281. For the genesis of the University, and for the reason why Cambridge became a university centre, it is necessary to go back to a date which is even more remote. The seed of learning which took root and germinated was planted here because from an early date, certainly before the reign of King John, Cambridge was a town of great commercial importance, and once a year, from August 24th to September 28th, the far-famed Stourbridge Fair was held on a tract of ground adjoining an open site now known as Midsummer Common. This fair grew with ever-increasing importance until the middle of the eighteenth century, when it reached its zenith; it then gradually waned and sank into insignificance. It attracted merchants from every part of Europe, and Defoe, who visited it in the early part of the eighteenth century, speaks of it as exceeding in importance any similar fair in this country or elsewhere. A great street of booths called Cheapside, half a mile in length, was erected, and here, as well as in lesser streets, merchandise of every description was exposed for sale. In one booth belonging to a Norwich dealer, Defoe speaks of seeing stuffs stored to the value of twenty thousand pounds, and the quantity of wool disposed of at the fair, he says, amounted to between fifty and sixty thousand pounds in value. Out of this great fair some eight centuries ago the University had its origin, and the beginning, though mainly a matter of conjecture, can be visualised as having taken place in this manner. An itinerant friar, in the course of his journeyings from one monastery to another, finding himself in Cambridge at the time of the fair, when the town was full of strangers, may have seen his way to earn an honest penny by giving a short course of popular lectures. He finds an appreciative audience, the lectures are a success, he promises to repeat and extend them next year, and so from small intermittent beginnings systematic courses of instruction begin to take shape. One teacher no longer suffices; he engages understudies, and gradually out of this emerges a permanent official, originally known as the Rector, and the forerunner of the official head of the University now termed the Chancellor.

In the earliest stages of this evolution, before any of the colleges were founded, teaching was carried out in a number of separate houses, scattered throughout the town; but in 1278 the University was given a plot of ground by Nigel de Thornton, and on this site, with several small additions, a group of buildings took form, ranging around an open courtyard, and some of these buildings, or schools as they were termed, now form part of the existing University library.

The mediæval undergraduate was totally different from his modern counterpart. He came to the University when he was a mere boy of thirteen or fourteen, and only a small minority remained long enough to take a master's degree. In early days the University did not concern itself with the discipline or even the housing of these youthful students, though later, to check certain abuses, boarding houses, or hostels as they were called, were established. Even when the colleges were founded their object was to provide board, lodging, and a small stipend for teachers only. The designations, master and scholars, which appear in the foundation charters, mean in modern terminology master and fellows, and it was not until the sixteenth century that students were privileged to reside in colleges on the payment of a small annual charge. From the earliest days the University and the colleges, though serving a common cause, have been separate organisations. The University of the Middle Ages was a corporation of learned men associated for the purpose of teaching and for conferring degrees, primarily intended as a licence to teach. The teacher thus licensed became a member of the ruling body. The colleges, on the other hand, were originally founded to house and remunerate teachers, and it was only much later, as an after-

* Address to the Institution of Mechanical Engineers, July 14th, 1931.

thought, that they took up the duty of providing lodging and in some cases free maintenance for deserving students.

ENGINEERING IN CAMBRIDGE.

I will now pass on to describe very briefly the evolution of engineering education in this University. Ever since the days of Sir Isaac Newton and even earlier, Cambridge has taken a keen interest in scientific advances and fundamental research, and as soon as the advancement of engineering called for the help of exact science it was only natural that Cambridge scientists should play an active part in this progress. Conspicuous among these pioneers was Professor Willis, Jacksonian Professor in this University during the period of 1837–1875. The Jacksonian Professor is delightfully free to follow almost any path of knowledge he may care to pursue. It is true that he is placed under an obligation to discover a cure for gout, but that obligation does not appear to have weighed heavily upon the various eminent scientists who have occupied this chair. Professor Willis, among other activities, was keenly interested in mechanical engineering, and his work on the classification and analysis of mechanisms is a well-known landmark in the progress of engineering science. Appreciation of his work took the tangible form of the establishment in Cambridge of a Professorship of Mechanism and Applied Mechanics, an important step forward towards the foundation of a school of engineering.

The first occupant of this new chair was James Stewart, who took office in 1875, and under his direction regular courses of engineering instruction were started and engineering workshops established. Stewart was an inspiring teacher of exceptional brilliance; his activities were far-reaching and his name in Cambridge is, perhaps, most generally remembered in connection with University Extension Lectures, a movement which he initiated. The work he did for engineering science in Cambridge should not, however, be forgotten, since he paved the way for a further advance and laid the foundations on which his successor could build with confidence. For this successor we do not have to conjure up shades of the departed great. He is very much a living force, and I refer to the ever-young and ever-vigorous Sir Alfred Ewing. He was appointed Professor of Mechanism and Applied Mechanics in 1890, and those who are familiar with his tactful, yet determined character, will realise that under his direction it was inevitable that the study of engineering science should attain a position of dignity and importance in the University. Under the name of the Mechanical Sciences Tripos, a name which still survives, he soon had engineering accepted as an honours course of study, and he laid down the general principles by which such a University course should be governed. From these broad principles we have never departed, and how well he had sown becomes more and more apparent with the passage of time. Sir Alfred Ewing is the real patron saint of the Cambridge Engineering School, but, in so far as his mental and bodily energies are still those associated with a comparatively young man, his canonisation is not a problem for the present generation. Sir Alfred left in 1904 to become Director of Naval Education, and the mantle of Elisha fell upon a very worthy successor, Bertram Hopkinson, who had inherited in full measure the genius of his distinguished father, Dr. John Hopkinson. Under his virile leadership and under the influence of a mind which had no use for anything which was not first class, the Cambridge Engineering School advanced from strength to strength, or, as the students might put it, from difficulties to yet more profound difficulties. His death through a flying accident during the war was an irreparable loss to engineering science. Men of the character and mental calibre of Bertram Hopkinson are unique and irreplaceable.

During the war, engineering, like all other academic subjects in Cambridge, was almost completely denuded of students, but the subsequent renaissance was unexpectedly sudden and quite overwhelming in its exuberance. The cubic contents of our original premises were quite incapable of dealing with the deluge, and the University acquired for our needs a new site, on which we hastened to erect commodious laboratories. Financial stringency compelled us to retain our workshops and some lecture rooms on the old site, an inconvenient division of activities which has just come to an end. We are now completely housed on the Scroope House site, and the Conversazione, to which you are bidden on Thursday evening, really inaugurates the opening of these new premises, which render us once again after a period of ten years a self-contained establishment.

I mentioned that in the Cambridge Engineering School we are working on the lines laid down by Sir Alfred Ewing about forty years ago, and very briefly I should like to indicate those lines. We aim at giving our students the broad general principles which underlie all the main departments of engineering rather than an intensive training in any one particular branch. The honours course extends over three years, and it is only in their third year that students are permitted to specialise, and then only to a limited extent. In their Tripos they are tested as to their knowledge over a wide range of subjects, and no options are permitted whereby this test of basic knowledge can be less comprehensive. As the result of this broad training we do not claim to mould our students into full-fledged engineers, but we do claim that they acquire a working knowledge of the fundamental principles underlying all branches of engineering, structural, mechanical and electrical. They are not specialists in any one direction, but they possess a versatility and balance of mind which enables them to strike out with equal facility along any line they may subsequently be called upon to pursue. Premature specialisation cramps the imagination and is destructive to the length and breadth of mental vision. Give me a youngster who has had his foundations of belief widely and deeply laid, and I will back him, at long odds, to overtake and surpass at his own game one of equal native intelligence, who has had his imagination cramped by premature specialisation.

In a university course of engineering, instruction should primarily concentrate on teaching those essentials which, if not acquired at that stage, never will be acquired. Technicalities which will automatically be picked up in a student's subsequent career are useful as stimulating interest, but apart from this they are of secondary importance. Education does not consist in the memorisation of a number of facts and formulæ, useful as these may be when leavened with intelligence. Education at its best should aim at something much deeper and more lasting, and the good of education is the power of reasoning, and the habit of mind which remains, when all efforts of memorisation have faded into oblivion.

By following this ideal our engineering students, when they leave our hands, are necessarily lop-sided creations, and we must leave it to their subsequent employers to rectify this lack of symmetry. We hope for sympathetic treatment in this process. We hope that it will be done by filling in the hollows rather than flattening down the excrescences. These bumps ought not to be treated as indications of a swelled head; they are bumps of knowledge, and as such are deserving of respect.

The number of engineering students in Cambridge is about 500, of which approximately two-thirds are taking the honours course. In keenness and intelligence they compare most favourably with their pre-war brethren, and one can say with perfect assurance that recruiting for the engineering profession never stood higher than it does at the present time.

CAREERS FOR GRADUATES.

My only fear, and it is a very real fear, is that this excellent raw material may be spoilt in its subsequent treatment, and the best of it diverted at an early stage to other professions, which, rightly or wrongly, appear to offer greater opportunities for initiative and ability. We hear a great deal about the desirability of attracting to the engineering profession young men of the highest character and intellectual capacity, and the demand for university graduates is becoming more and more insistent. Now it is easy enough to attract them, but can you retain the best of them? When one inquires about the progress of former students, far too frequently it transpires that the more brilliant of these, after two or three years' experience, have left the engineering profession altogether, or at any rate have switched over from the technical to the administrative side. The causes of this are twofold. In the first place, the stipend offered to a junior technical engineer, in comparison with what he could earn in other walks of life, is usually so meagre that it is almost an insult to his intelligence and self-respect. Engineering as a career for men of education has now many rival competitors, and if it is to hold its own in this competition it must recognise that young men of first-rate ability cannot be retained under a scale of remuneration which makes it impossible for them to marry or even enjoy the luxury of a first-class illness. But there is a second and perhaps even more disturbing influence. Firms are continually asking for young men of exceptional ability, but having got them, not infrequently, they have not the foggiest notion how they should be employed. Razors are poor implements for cutting bricks, and a chisel, if used as a screw driver, is apt to lose its edge To develop the latent powers of high-class engineering students and to retain their keenness you must give them problems to solve which will stretch their brains. You must give them responsibility at an early stage, you must even let them learn by making mistakes. In too many firms it seems to me there is a buoyant layer of ability at the bottom, and another layer of ability at the top, but in between there is a medium of high resistance, and low permeability, a region of those who have not the buoyancy to rise higher, but are content in a painstaking manner to perpetuate the mistakes of their predecessors. It might be hoped that this state of affairs would be rectified in time when the brighter underlayer has ascended by reason of its buoyancy. But this hope is not fulfilled, because in the course of the ascent the brighter specimens rebel at the conditions they find and in consequence the middle layer of mediocrity tends to a regrettable state of permanent stability.

Now it is easier to point out a defect than to propose a remedy, but the solution I would suggest as a cure for this impasse is to riddle this stagnant layer with many more posts in the nature of personal assistants to managers or directors. Young men of proved ability, after they have undergone a general works experience, could thus be set to study special problems which would develop their brain powers and, coming with authority from on high, their initiative would not be suppressed, as is all too likely, if they try and assert themselves without influential support. A few posts of this sort would have the good effect of inducing men of exceptional ability to remain on the technical side of an engineering undertaking, and, by bringing them into the managerial atmosphere, would fit them ultimately for positions of high responsibility. It might even break down that impassable barrier which in this country seems to debar men of technical knowledge from becoming directors of the undertaking they have served. It is little short of a scandal to find how few men of technical ability attain to this exalted station.

The reason given is that the technical man has too restricted a vision to be useful in that capacity, but the true explanation is that we are working in a vicious circle. Owing to the barrier they see before them, men of first-rate ability will not remain on the technical side, and the residue quite rightly is not regarded as having the requisite personality for the highest posts.

I do not, however, wish to mar this joyous gathering with a note of pessimism; I merely want to indicate certain defects, the elimination of which, in my opinion, would have a most beneficial effect in rejuvenating the engineering profession in this country. In spite of what I have said, I think engineering is a splendid and soul-stirring career, and I always encourage young men who have the spirit of adventure to give it a trial. In this task of recruiting sergeant one's conscience would perhaps feel less disturbed if it was reasonably certain that after a probationary period engineering students of first-rate ability, but no family influence, could always see clearly before them a vista of advancement and in particular an avenue along the technical side leading straight on to the topmost pinnacles of the engineering profession.

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Locomotive Experimental Stations.*

By H. N. GRESLEY, C.B.E., *Member of Council.*

ALTHOUGH great developments have been made in locomotives since their first inception, progress towards increased efficiency has been hampered by difficulties in carrying out technical experiments. With other prime movers it is not difficult to devise means to make satisfactory tests, such as on stationary engines, which can generally be worked for long periods at a constant power output, the efficiency of the engine being measured by means of a brake. Electrical machinery can be tested with great accuracy, and the performances of ships can be tested and measured. The characteristics of motor car engines can be fully investigated on test-beds, and appliances have been developed to test the efficiency also of the essential parts, such as transmission gear and springs. Aeroplane engines can be similarly tested, and the design of bodies and wings can be investigated in wind channels.

But the locomotive builder is at a great disadvantage when his facilities are compared with those already mentioned. The private builder has practically no facilities. Railway companies, building their own locomotives, can use their own tracks, and by the employment of dynamometer cars, can obtain a certain amount of useful information, but atmospheric conditions and variations in gradients make it impossible to obtain conditions sufficiently uniform to make accurate comparisons. Attempts have been made in Germany to maintain constant power output by means of an engine in the rear acting as a brake, or supplying extra power when needed, but even if this were satisfactory, variable conditions still remain. These variable conditions can be eliminated on a stationary testing plant, in which the locomotive is anchored to a device recording its pull whilst the wheels rotate on supporting rollers, whose resistance to rotation can be controlled.

This country has been the pioneer in locomotive construction. It has built locomotives for export to all parts of the world, and has still a good name for first-class workmanship and design. Other countries are, however, now challenging our position, and are going ahead with the development of scientific appliances so that their designs can be improved. This country cannot afford to rest on its past achievements, and it is rather humiliating to have to admit that when we require technical data in connection with locomotives, we have to rely on experiments made in other countries where locomotive testing has developed to a greater extent than it has done here. The author considers that such a state of things should not be allowed to continue, and in this paper submits the suggestion for the design of a suitable plant. It is desirable here, briefly to outline the developments in the matter of locomototive experimental stations which have been made in other countries.

The first plant on which a locomotive could be tested when running on its driving wheels was installed at Purdue University, and came into operation at the end of 1891. The plant consisted of two pairs of supporting wheels carried in bearings secured to a framework of oak beams fixed to foundations in a pit. The wheels were fitted with tires turned to the profile of a standard rail. The tops of these wheels were at floor level. Rails extended along either side of the pit, and carried the bogie wheels when the engine was in position. These rails were cut away to clear the supporting wheels, and in order to obtain a continuous track on which the locomotive could be run into position, temporary rails of a special pattern were fixed on the inner sides of the supporting wheels, the tops being grooved to fit the locomotive flanges. The driving and coupled wheels were brought exactly to the tops of the supporting wheels, and the rear locomotive drawhook was then coupled to the apparatus for measuring the draw-bar pull. This was a system of compound levers, the load being measured on a horizontal steelyard fitted with a dashpot control to check vibration.

The rotation of the driving wheels tended to make the locomotive move forward off the crowns of the supporting wheels, but the leverage of the weighing apparatus was such that practically no forward motion was permitted. The resistance to rotation was provided by four brakes coupled to the outer ends of the axles carrying the supporting wheels. These were of the Alden type, each brake containing a steel disc rotating between two sheet copper diaphragms. The other sides of these diaphragms were subjected to water pressure, and this forced them against the steel disc. The rubbing surfaces were adequately lubricated, and the resistance to rotation of the disc was regulated by varying the water pressure. This water was kept circulating and, therefore, formed a means to carry away the heat generated.

The plant was almost destroyed by fire in 1894, but was rebuilt and improved. Better foundations were installed with provision for further braked wheels, so that six or eight-coupled engines could be accommodated. The weighing head of an Emery testing machine was adopted for use as a traction dynamometer in place of the previous compound levers.

The Chicago and North-Western Railway brought an experimental testing plant into operation in 1895, and Columbia University installed one in 1899, but the greatest step forward was made by the Pennsylvania Railway Company, who installed a plant at the St. Louis Exhibition in 1904, where it was in operation for about six months before being finally transferred to their shops at Altoona. An elevation of the plant is shown in Fig. 1.

The base of the pit is formed on a concrete bed about 5ft. in thickness. Cast iron bed-plates are secured to the concrete foundation. These are provided with slots so that the pedestals of the supporting wheels can be moved to any required position. The tires of these wheels have the same contour as a standard rail on their inner sides, the outer part being V-shaped, so that any oil that creeps up from the outside bearings will be thrown off, and not get on the treads.

In this plant, as in previous ones, only the driving and coupled wheels rotate, the other parts being carried on a fixed track. On bringing a locomotive into position removable rails, which support the locomotive on its flanges, are used. They are slightly lower than the supporting wheels, so that when the locomotive is in position, no weight is on them, and they can easily be withdrawn.

Brakes of the Alden type are used on this plant. They are about 3ft. 6in. in diameter and are fitted at each end of each axle. Each brake has two rotating discs with four sheet copper diaphragms.

The traction dynamometer has a maximum capacity of about 35 tons. It is of the compound lever type. The fulcrum points are carried on Emery fulcrum plates in place of knife edges, the constraint at the end of the lever system, remote from the draw-bar, being given by flat springs, which can be changed according to the capacity required.

To ensure accurate results it is essential that there should be practically no forward motion of the locomotive on the supporting wheels when exerting a pull, and on this plant this motion is restricted to 0·04in. at full capacity. This gives an 8in. movement at the other end of the lever system, which is coupled to a pen recording mechanism that traces the draw-bar pull on a travelling roll of paper, which receives its motion by gearing from the wheels. The table over which the paper moves is similar to that in a dynamometer car, and carries electrically actuated time-recording pens, and a device to compute the work done. There are adequate coal weighing arrangements, and water measuring tanks are provided for both metering and weighing.

In 1905 an experimental testing plant was installed in this country at the Swindon works of the Great Western Railway Company. In this plant all the wheels rotate, and it can thus be used for running in an engine after repairs, so that the bearings are in proper condition before sending it out into traffic. A diagram of this plant is shown in Fig. 2.†

The three supporting wheels are 4ft. 1½in. diameter, and their shafts carry pulleys at each end 3ft. 6in. diameter and 18in. wide. A belt runs over these and under four pulleys below them, that marked A being coupled to an air compressor for shop use. Allowance has to be made for differences in wheel spacing, and the pulley below A at the left side is mounted on a swinging frame and compensates for this. The bogie wheels are driven by separate belts from the pulley below the front supporting wheel, and similar compensation is provided for these. As the air compressor does not furnish a sufficiently steady retarding force to the supporting wheels, the final regulation is done on band brakes inside the pulleys at each end of each supporting wheel. One of these is shown at D.

The load producing the braking is obtained by hydraulic cylinders. One of these is shown at E. The pressure is furnished by a pump working on the flow-and-return system, a loaded valve controlled by a governor regulating the pressure. Water is led to the brake bands for cooling purposes by means of the flexible pipes shown. The draw-bar pull is measured by means of a compound lever and weights, with dashpot control. Coal weighing apparatus is provided, also water measuring tanks.

A smoke stack is fixed in the roof with the underside flared out sufficiently to suit locomotives of different wheel base. The underside is closed by a sliding plate penetrated by a chimney, which can be set immediately above that of the locomotive. The cavity above this serves as a receptacle for ejected ashes. The plant has done useful service, but the capacity is too small for testing modern locomotives under full power, as the brakes are constructed to absorb only about 500 H.P.

An experimental testing plant has been installed for the German State Railways at Grunewald, and was brought into use in June of last year. Fig. 3 shows an elevation of this.

It will be seen to consist of two buildings. The small one

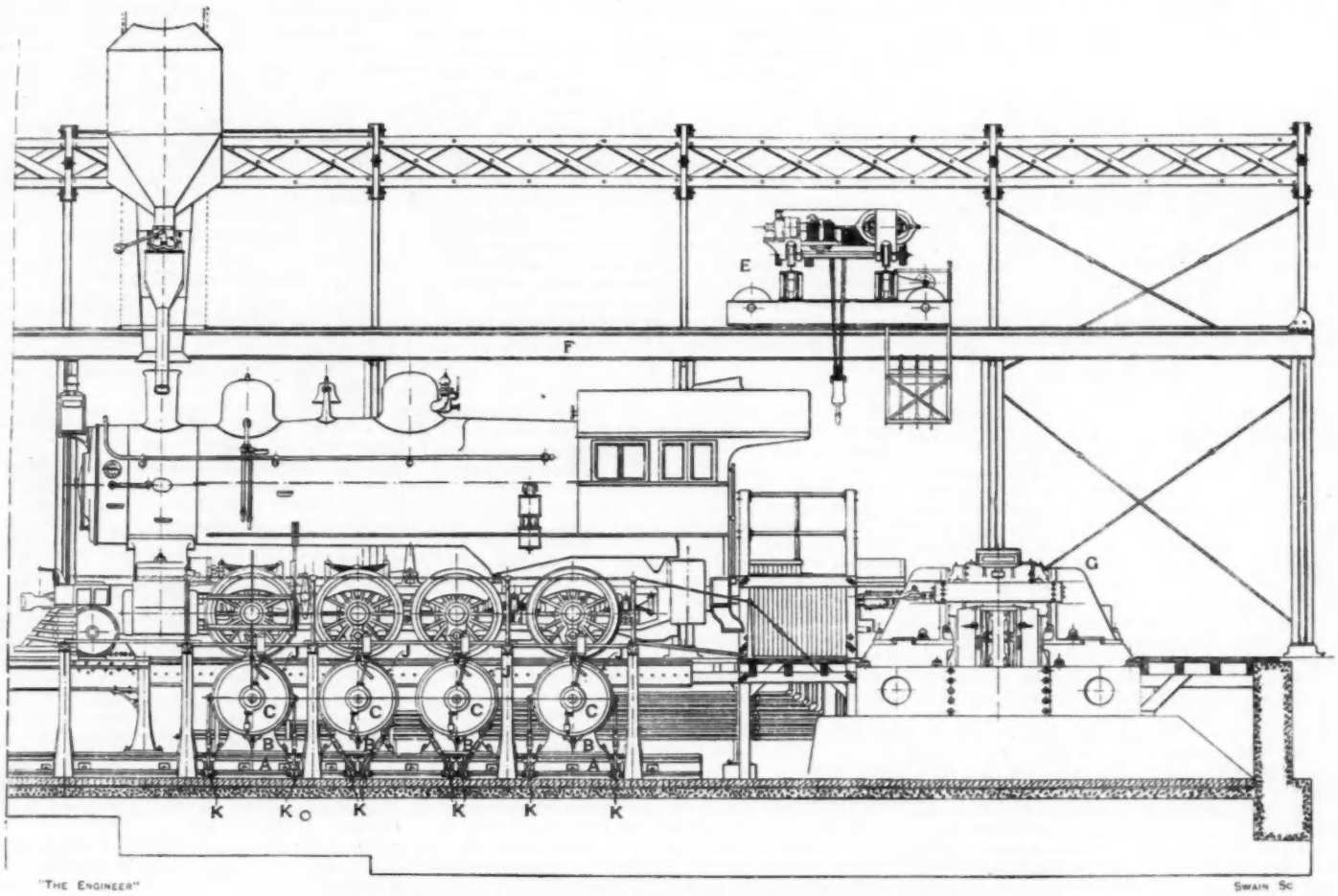


FIG. 1—LOCOMOTIVE EXPERIMENTAL STATION, PENNSYLVANIA RAILROAD

* Inst. of Mech. Eng., Cambridge Meeting, July 14th, 1931.

† Reproduced from a Supplement to THE ENGINEER, December 22nd, 1905.

on the left contains a dynamometer and other measuring instruments, such as speedometers, pyrometers, and gas analysis recorders. Installing this apparatus in a separate building has the advantage of keeping it and the experimenters away from the noise and possible vibration, but introduces transmission difficulties. The main building is 137ft. long. It is spanned by a 10-ton crane, and contains an overhead coal bunker, and arrangements for exhausting smoke and ashes.

in speed. The water is supplied at a pressure of about 45 lb. per square inch, and as it was inconvenient to get this pressure from a head of water, it is obtained by keeping the supply tanks under air pressure.

There is less tendency for a driving wheel to slip when running on a rail than when rotating the rim of a braked wheel, as in the latter case the portion in contact is smaller, and the surface tends to become greasy owing to leakage of oil and condensation of any steam charged with lubri-

the engine off the test bed for this purpose.

The dynamometer is of the hydraulic type, a cylinder and plunger fixed in the framing at the rear of the locomotive draw hook transmitting fluid pressure by pipes to the recording room, where it actuates a plunger against the resistance of a calibrated spring. This is coupled to a recording pen which traces a curve of draw-bar pull on a roll of paper on the instrument table. It also actuates an integrator for recording the work done. Pistons of different

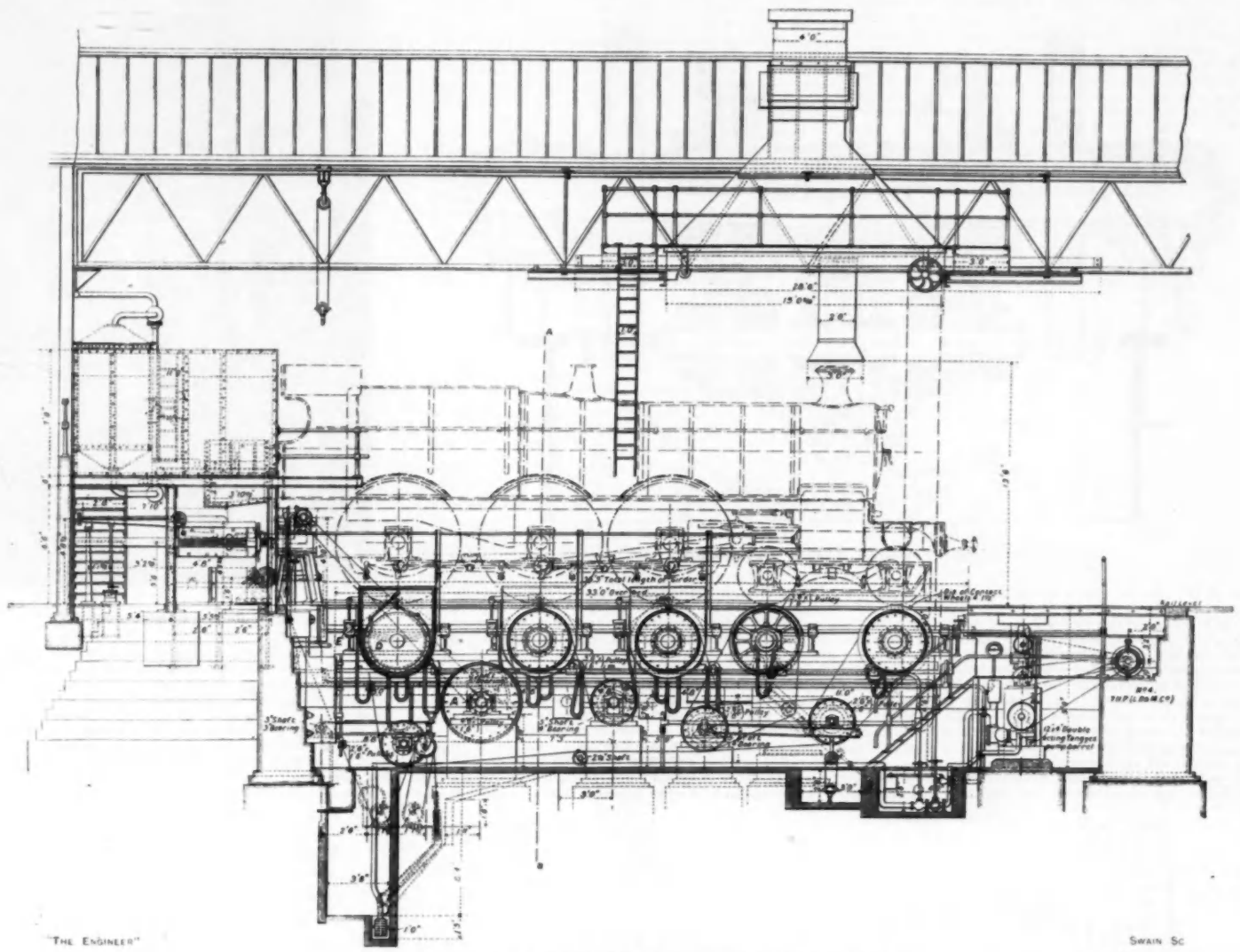


FIG. 2—LOCOMOTIVE TESTING PLANT, G.W. RAILWAY, SWINDON

To ensure that the vibration of the locomotive on the test bed shall not be transmitted to the building, the foundations for each are independent of one another. The supporting wheels are carried on a rigid built-up girder, so arranged that they can be adjusted in any required position. In order that they can be accurately aligned in relation to the locomotive wheels a special optical measuring arrangement is provided.

cant. A good deal of trouble was experienced due to slipping on the American plants, and as this slipping forms flat spots on the carrying wheels, which have to be ground out, attempts were made to obviate the trouble, and special sanding devices have been incorporated. These are shown in Fig. 5. Sand is projected by compressed air between the rolling surfaces, and immediately opposite this is a protecting box, which covers the lower part of the locomotive

area can be used according to the capacity of the locomotive being tested, three ranges being employed, the maximum capacities being 3, 14, and 32 tons respectively. The movement of the recording roll is obtained mechanically from one of the driven axles of the locomotive. The speed of revolution is obtained in a similar manner and by electrical means.

The pyrometers used are of the electrical type, the indi-

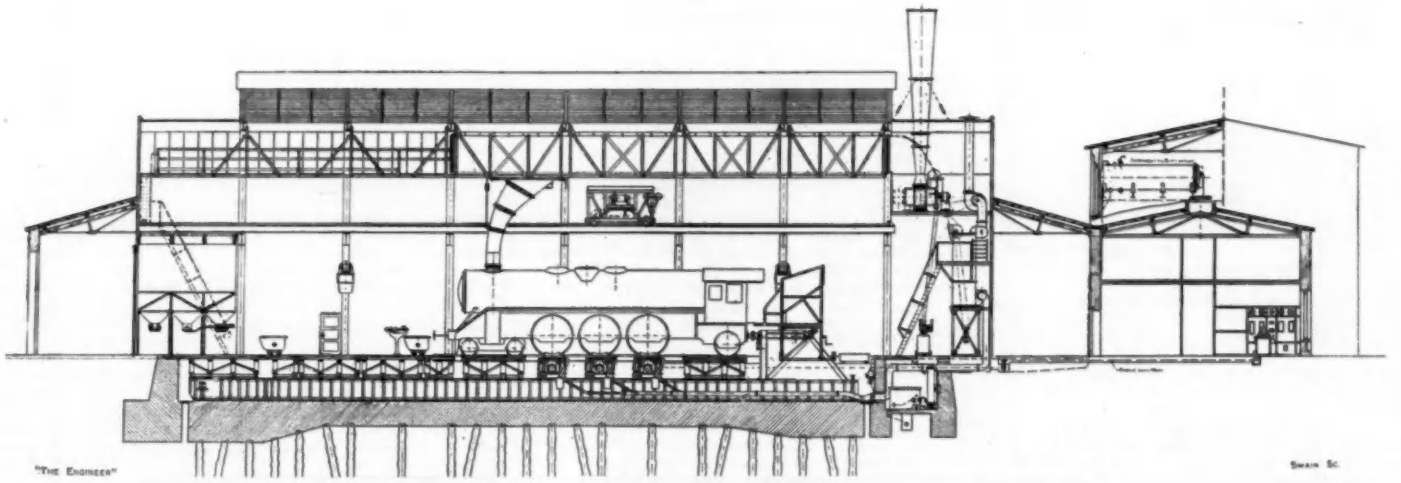


FIG. 3—GRUNEWALD LOCOMOTIVE EXPERIMENTAL STATION, GERMAN STATE RAILWAYS

A departure from previous practice has been made in the braking arrangement, Froude water brakes being used, each carrying wheel having one of these at its centre. As the efficiency of this type of brake is low at low speeds, they are geared up, gear ratios of 5 to 1 and 2½ to 1 being provided according to the type of locomotive being tested. This arrangement is shown in Fig. 4. It is claimed that the brake is much more suitable than those dependent on surfaces in contact, as it compensates better for changes

wheels and the top of the carrying wheels. This is coupled to an exhauster, which draws off the sand after it has passed between the surfaces, and prevents it getting on to any of the bearings.

Adequate provision is made for measurement of coal and water, and in addition to this arrangements are devised so that the weight of unburnt fuel passing away with the smoke-box gases can be determined. Arrangements are also made so that the fire can be cleaned without taking

cators in connection with them being brought back into the recording room. Continuous records are also obtained of the composition of smoke-box gases.

In addition to the instruments in the recording room, an instrument board is installed near the locomotive, and shows on dials the revolution rate, draw-bar pull, smoke-box vacuum and other particulars, such as pressure of the water supply to the brakes, and lubricating oil pressure for the test bed machinery.

An experimental station is now being constructed at Vitry-sur-Seine, near Paris, to designs prepared by the Office Centrale d'Etudes de Matérial, and it is anticipated that it will be completed early next year. Fig. 6 shows the arrangement diagrammatically. The building will be about 180ft. long and about 80ft. wide, a portion of it being reserved for a machine shop. It is proposed to equip it with two overhead travelling cranes, each having 40 tons capacity. The supporting wheels are 51in. in diameter with outside bearings, and suitable for carrying a maximum load of 30 tons, the shafts being directly coupled to the brakes as shown.

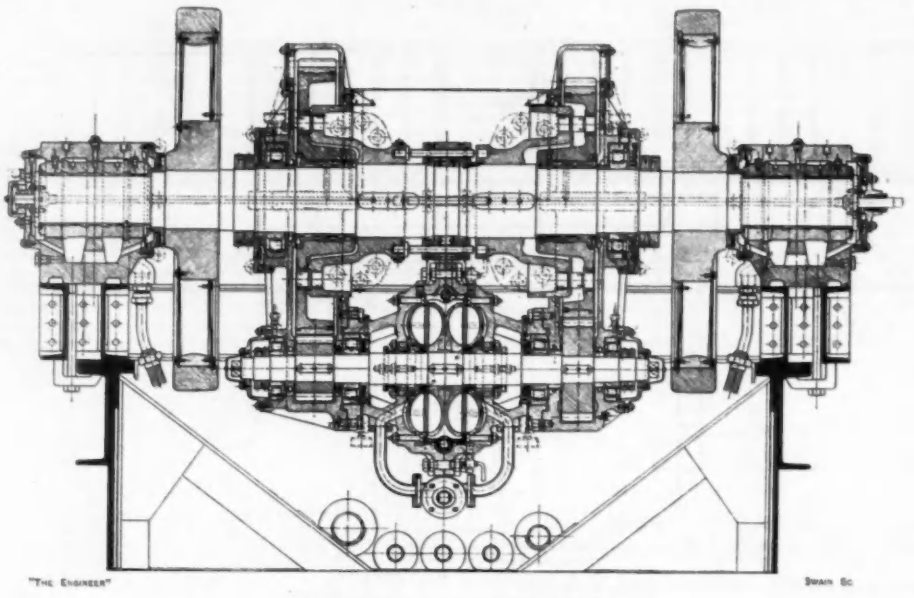


FIG. 4—FROUDE BRAKE, GRUNEWALD

It is proposed to use Froude brakes on this plant, and it is specified that each brake must be capable of absorbing about 300 H.P. at 60 r.p.m. and 1000 H.P. at 360 r.p.m. These brakes are supplied with water under pressure, and it is customary to obtain this pressure either by head of water or keeping a supply tank under air pressure, but in this plant it is proposed that the pressure should be obtained by means of pumps attached to each brake, and actuated from the carrying wheels, it being thought that this method will allow of closer regulation.

It is specified that the dynamometer shall have a maximum capacity of 40 tons, and shall actuate a recording apparatus, which will trace the tractive force at the draw-bar on a travelling roll of paper, the scale to be capable of modification so that it can be more open when testing under lighter loads. No special type of dynamometer has yet been decided on, but the Amsler hydraulic type appears to be favoured. The dynamometer is situated in the room at the rear of the test bed. Means are provided for measuring fuel and water and products of combustion.

The author has long felt that there is a great need for the provision of a locomotive experimental testing plant in Great Britain, and has frequently advocated the desirability of the construction of such a plant. It would have to be so arranged that it could be capable of testing locomotives of any gauge which is extensively used throughout the British Empire. It is obvious that if such a plant were provided advantage would be taken of the experience obtained with plants built on the Continent and in the United States. It is desirable that such a plant should embody features which would enable the locomotives to be tested under conditions approximating more closely to running conditions than those in the plants which have been described. For this reason it is suggested that the locomotive could be placed in a wind tunnel, as this would reproduce the effect of running conditions on the rate of combustion. It would also more closely indicate the output of the locomotive under running conditions, in that the resistance due to wind pressure would have to be overcome by the engine under test, and consequently the pull recorded on the draw-bar would be almost exactly the same as would be given if the engine were hauling a train. The provision of a wind tunnel will add to the cost of an experimental testing station, and as it is in the nature of a refinement rather than an essential feature, it would probably be cheaper to so design the plant that the wind tunnel can be provided at a subsequent date if the first cost is to be kept down.

The provision of a wind tunnel necessitates a radical departure from the conventional type of locomotive experimental station, in that the locomotive under test would have to furnish the power necessary to draw air through the tunnel past the locomotive. In order to reduce sufficiently the effect of eddy currents, the cross section of the tunnel would probably have to be about 25ft. by 30ft. It will be appreciated that a very large amount of power would be required to produce a wind of 50 to 60 miles an hour in a wind tunnel of these dimensions, and it is estimated that motors for driving the fans of about 2000 H.P. will be required. On the other hand, in carrying out tests at low speeds, the power required to drive the fans would probably be much less than the locomotive under test was producing. The carrying wheels would therefore have to be so arranged that the power produced by the locomotive would have to be absorbed by dynamos when working at high speeds and by brakes when running at low speeds.

FIG. 5—SANDING ARRANGEMENT

Instead, therefore, of having independent brakes directly coupled to the shafts of each of the supporting wheels, it is suggested that two heavy splined shafts shall be provided running lengthways along each side of the locomotive testing pit and coupled to the supporting wheels by means of large bevelled gears. Two long bed-plates would be required for this arrangement on which the supporting wheels and their gears will slide. These

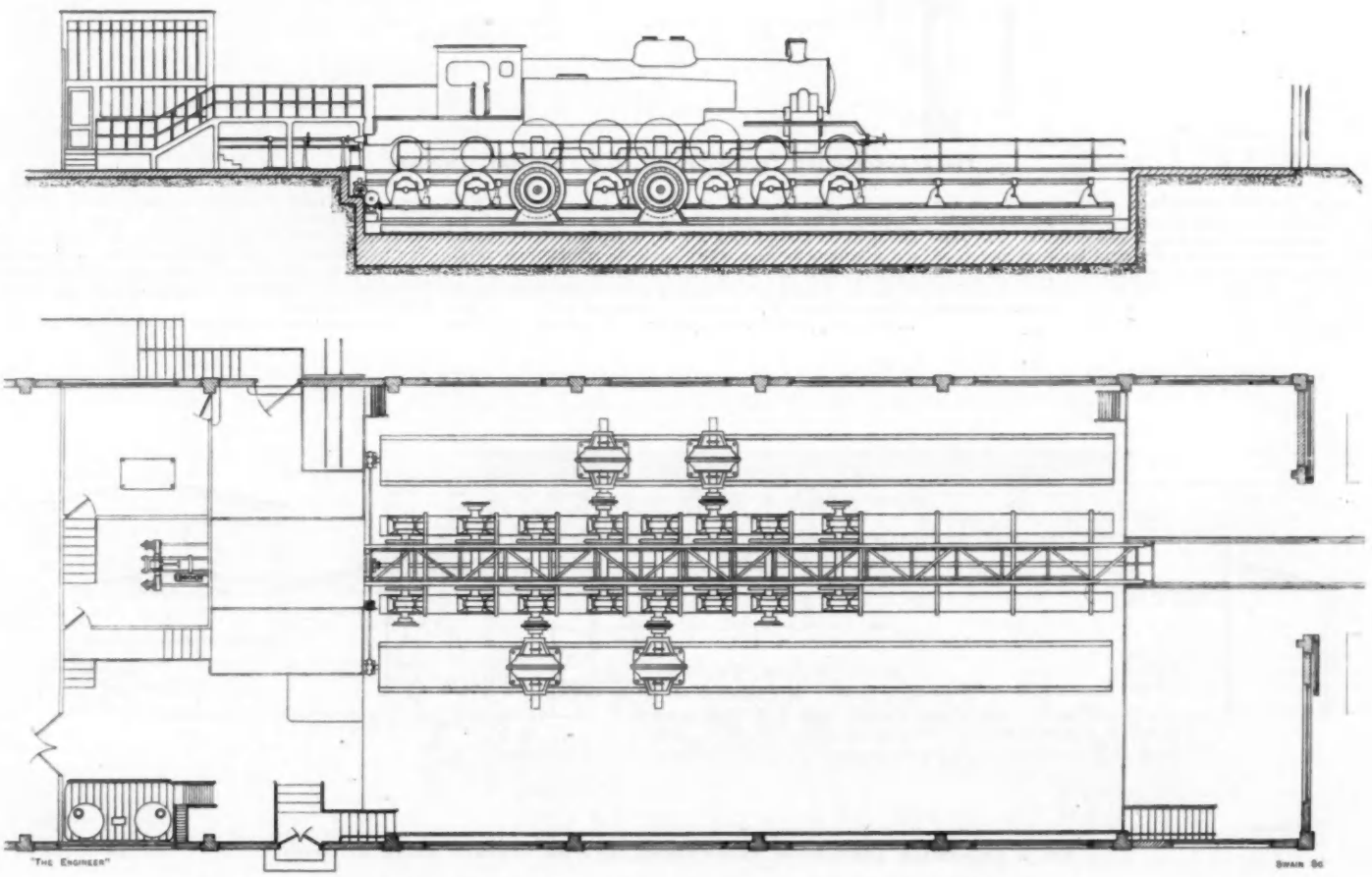
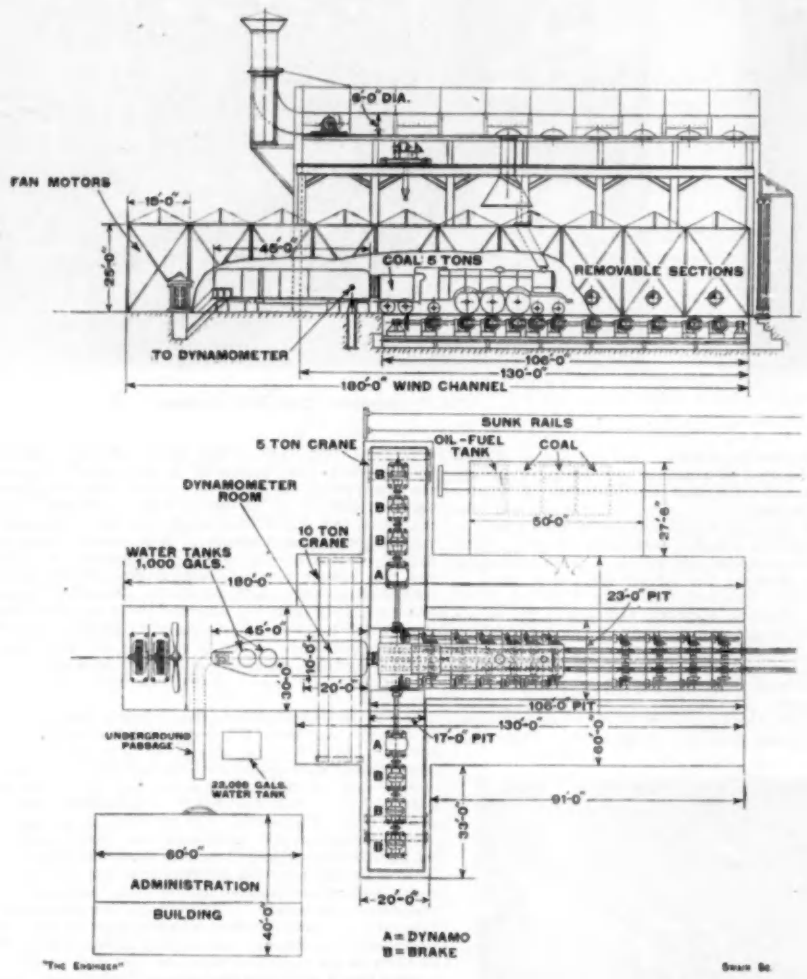


FIG. 6—PROPOSED LOCOMOTIVE EXPERIMENTAL STATION, FRENCH RAILWAYS

two long shafts at their rear end would drive the cross shafts to which they will be suitably geared so that the cross shafts run at a higher speed. On these cross shafts hydraulic brakes and dynamos will be fitted and their foundations will be permanent, as their position is not dependent upon that of the locomotive wheels. The lay-out of such a plant is shown diagrammatically in Fig. 7.

At low speeds practically the whole of the power generated would be absorbed by the hydraulic brakes, but at higher speeds the braking would be obtained from the dynamos and the system would allow for a graduation of power between the brakes and the dynamos at intermediate speeds. From inquiries which have been made from the gear manufacturers there does not appear to be any difficulty in satisfactorily transmitting up to 750 H.P. from the supporting wheels through each pair of bevelled gears driving the longitudinal shafts. Probably four sets of supporting wheels with brakes and dynamos capable of absorbing 3000 H.P. in all would be sufficient.

At the rear of the locomotive a firing platform, approximating to the shape of a tender, should be provided, this being on wheels so that when testing tank engines it could be removed. It would be adequately covered over so that coal dust is not disturbed by the wind, and there will be a corridor connection to the dynamometer room. The underneath would approximate in profile to a tender to



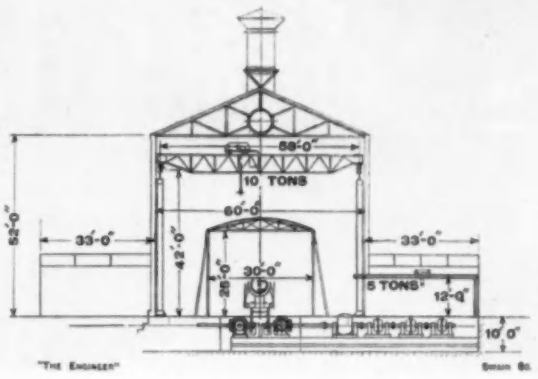


FIG. 7—PROPOSED BRITISH LOCOMOTIVE EXPERIMENTAL STATION

ensure proper air currents entering the ashpan. The locomotive draw-bar would be coupled to a suitably supported rod, adjustable lengthways, passing under the firing platform.

The dynamometer room would have the same contour as a railway carriage, and as the back end would be immediately in front of the fan it should be streamlined to assist in obtaining parallel wind flow.

The water measuring tanks would be placed in the rear, being fed from the main tank and filled alternately. In order to create no additional resistance to wind flow, access to the dynamometer room should be obtained by an underground passage.

The usual facilities for coal and water measurement and adequate water supply for the brakes would be provided, and means for cleaning the fire and emptying the ashpan. As there would be no gear in the pit under the supporting wheels, it should be possible to devise some type of conveyor which would enable the ashes to be got rid of without taking the locomotive off the test bed for this purpose. A smoke stack and ash collector would also be provided.

A machine shop should be provided so that any minor repairs to the plant can be effected, and as the plant will accommodate locomotives of varying gauge, those other than the standard will have to be transported to the plant in sections and assembled there. This will entail provision for erection, and these locomotives will have to be assembled on a road containing multi-gauge track, and run from there on to the test plant, and it will probably be necessary to provide large-capacity cranes in this shop to facilitate the handling of the locomotives.

An administrative building should also be provided a reasonable distance from the plant, so that the computers, and those engaged in other duties requiring mental concentration, are not affected by the noise of the plant.

It will be realised that a locomotive testing plant arranged on the lines outlined by the author embodies many features of an essentially novel character, and there is much detail work still to be done before the scheme can be regarded as complete. On the other hand, it is claimed that such a plant offers considerable advantages :—

(1) The provision of a wind tunnel in which a locomotive can be tested.

(2) The arrangement of coupling the supporting wheels by means of bevelled gears directly to the longitudinal shafts produces conditions which approxmate more closely to normal running conditions. Under normal running conditions a locomotive progresses along a fixed rail. Therefore a fixed locomotive should drive something resembling a caterpillar track, and the nearest workable mechanical arrangement to this is a set of supporting wheels rigidly coupled together. This eliminates the possibility of slipping on one of the supporting wheels, and the proportion of the power transmitted through the coupling rods is approximately the same as that which is obtained under running conditions.

(3) With the braking equipment concentrated in one place, fixed on rigid foundations, and away from the supporting wheels, the brakes are more accessible and can be more readily adjusted, and the use of flexible pipes, which is necessary if the brakes are directly coupled to the supporting wheels, is obviated.

In conclusion, the author submits that the provision of a British locomotive experimental station is more essential now than at any other time. On the Continent and in America large sums of money are being expended upon the scientific development of locomotives, and these countries are obtaining orders in markets which were formerly wholly British. To meet this competition and to provide for this country locomotives of the highest efficiency it is necessary that we should have equipment second to none for the investigation of locomotive economy.

The plant would be available not only for carrying out experiments on new locomotive designs, but would offer means of making investigation into the economies which may be effected by the use of higher pressures, new valve gears, feed-water heating, boosters, poppet valves, &c. With the wind tunnel this would make it possible to explore more fully the possibilities of the application of condensing apparatus to locomotives.

By the provision of such a plant as that suggested, experiments could be carried out with engines and their components by scientific methods, and would produce data which would be of incalculable value in arriving at the best locomotive design.

The author wishes to express acknowledgment of the assistance rendered by his assistant, Mr. T. Robson, in the preparation of the diagrams and designs which appear in this paper. Acknowledgment should also be made to the Director of the Office Centrale d'Etudes de Matériel at Paris for the particulars furnished of the French Experimental Station and to *Glasers Annalen* for the illustrations of the German Experimental Station.

SOME large graneries for the storage of cereals are to be put up at Nanking. Ten are to be constructed immediately, but it is intended to build thirty, so as to provide three months' storage.

BRITISH WATERWORKS ASSOCIATION.

THE twentieth annual general meeting and conference of the British Waterworks Association will be held at Belfast from July 21st to 25th next, inclusive. The following order of proceedings has been arranged :—On Tuesday, July 21st, at 5 p.m., there will be a meeting of the executive committee of the Association at the Municipal College of Technology, College Square East. On the Wednesday, at 11 a.m., the meeting and conference of the British Waterworks Association will be held in the Municipal College of Technology, when the members will be welcomed by the Right Hon. the Lord Mayor of Belfast, Sir Crawford McCullagh. After the transaction of business matters the incoming President will be installed and will deliver his presidential address. Thereafter the following notice will be put before the meeting :—" That the Executive Committee of the British Waterworks Association do approach the Institution of Civil Engineers, the Institution of Water Engineers, and the Institution of Municipal and County Engineers with the object of obtaining their co-operation for the purpose of promoting a Bill in Parliament to amend Section 2, Sub-sections 2, 3, 4, 5, and Section 8 in particular of the Reservoirs (Safety Provisions) Act, 1930." The following paper will then be read and discussed :—" The Reduction of Sodium Sulphate by Bacteria and its Application to Water Examination," by Professor W. James Wilson, of Queen's University, Belfast, Water Examiner to Belfast City and District Water Commissioners. In the afternoon the following papers will be presented for discussion :—" The Geology of the Belfast Area, with Notes on Hydrology," by Mr. John J. Hartley, Assoc. M. Inst. C.E., Lecturer, Queen's University, Belfast ; and " The Silent Valley Reservoir," by the Board of Engineers (in charge of the constructive work). In the evening, at 7 p.m., there will be a reception at the Grand Central Hotel, by the President, which will be followed at 7.30 p.m. by the annual dinner.

On the Thursday there will be an inspection of the reservoir in course of construction in the Silent Valley, Mourne Mountains, the party leaving Belfast at 9.30 a.m. by motor omnibus. In the evening, from 8.30 to 10.30, there will be a reception at the City Hall by the Lord Mayor and Lady Mayoress.

On the Friday the following places of interest will be open for inspection :—Morning, (*a*) York-street Linen Factory ; (*b*) Gallaher's Tobacco Factory ; (*c*) Belfast Gasworks ; and (*d*) New Electricity Station, Queen's-road. Afternoon, (*e*) Belfast Ropeworks ; (*f*) New Parliament Buildings, Stormont, 3 miles from city centre ; (*g*) Sand Filters and other works at Oldpark ; (*h*) Queen's University and Municipal Art Gallery. For the Saturday a motor coach tour from Belfast to Portrush and Giant's Causeway by the coast road, returning by different route, arriving there before sailing time of Liverpool, Heysham, Ardrossan and Glasgow steamers ; and a golfing competition on a Belfast golf course have been arranged.

B.E.S.A. SPECIFICATIONS.

All B.E.S.A. Specifications can be obtained from the Publications Department of the Association at 28, Victoria-street, London, S.W. 1. The price of each specification is 2s. 2d. post free, unless otherwise stated.

CAST IRON SPIGOT AND SOCKET PIPES.

A revision of the British Standard Specifications for Cast Iron Soil, Waste, Ventilating, and Heavy Rainwater Pipes has just been issued in one volume, as British Standard Specification No. 416-1931. It supersedes two specifications (Nos. 58 and 59), which were first issued in 1912, the revision having become necessary owing to the new methods of manufacture which have been developed during the interval.

The pipes and fittings dealt with satisfy the requirements of the London County Council Drainage By-laws and the Model By-laws of the Ministry of Health. The specification provides for three grades of British standard pipe, enabling the architect or engineer to specify the appropriate grade for his purposes. Pipes and fittings made in accordance with this specification will be interchangeable with those formerly made, and pipes made to the various methods of manufacture at present in use will also be interchangeable. The specification includes the standards for connection to sanitary earthenware. The specification in draft form was circulated widely to public authorities throughout the United Kingdom, and a general readiness to adopt it has been widely expressed.

Remote-Control Switchgear at Woolwich.

AN interesting installation of remote electrically-controlled switchgear has been put into service at the Bellwater Gate power station of the Woolwich Borough Council. The total capacity of the generating plant is about 40,000 kW, and A.C. at 6600 volts is supplied to over fifty sub-stations in Woolwich, Eltham, Plumstead and North Woolwich. The turbo-alternators include two G.E.C. Fraser and Chalmers sets, one of 15,000 kVA and one of 7500 kVA and also a Fraser and Chalmers turbine driving a 2500 kVA alternator. The main part of the high-tension switchgear consists of fourteen G.E.C. stonework cubicles—Fig. 1—six of which control turbo-alternator sets, whilst five control two 6000 kVA outgoing feeders to Eltham, two previously-existing 15,000 kVA group feeders and a 3000 kVA works feeder. There is a 2000 ampère bus-bar coupler, a bus-bar potential transformer cubicle, and a spare cubicle for a future 25,000 kVA turbo-alternator. The switchgear is designed for a pressure of 6600 volts and is electrically-operated by remote control from corresponding panels on a main control board situated in a central position in the station. The cubicles are built up of moulded stonework slabs reinforced by steelwork.

The duplicate three-phase bus-bars are composed of hard-drawn copper of high conductivity. Complete phase separation is ensured by enclosing each set of the duplicate bus-bars in a large compound-filled non-magnetic aluminium alloy bus-bar chamber extending over the entire length of each switchboard and also between the two boards.

The equipment of the alternator and feeder cubicles includes a 3-pole oil circuit breaker, two sets of isolating switches—one for each set of bus-bars—and instrument transformers, including three single-phase current transformers and one three-phase potential transformer. The alternator cubicles are fitted with an extra set of current transformers for the circulating current protective gear, whilst the feeder cubicles have an extra set of isolating switches on the feeder side of the oil circuit breaker. The bus-bar coupler cubicle is equipped with a triple-pole oil circuit breaker, two sets of isolating switches, and three single-phase current transformers. The bus-bar potential transformer cubicle has two sets of two single-pole isolating switches and two single-phase potential transformers with H.T. fuses and current-limiting resistances. The spare alternator cubicle is fitted with isolating switches only.

All the oil circuit breakers are solenoid-operated, and are fitted with 220-volt D.C. trips and the necessary auxiliary switches, the solenoids and contactors for automatic opening and closing of the breakers being mounted on the front of the cubicles. Each breaker has a breaking capacity of at least 500,000 kVA, and is capable of rupturing a short circuit of that magnitude twice at a 2-minute interval, after which it is then still in a condition to be closed and to carry its rated current continuously without any overhaul or adjustment. Breakers of 600, 800, 1500 and 2000 ampères capacity are installed. In the design of the equipment special attention has been paid to the fact that the normal running load on the station will be at least 45,000 kVA, and that in the future it may be interconnected by means of step-up and step-down transformers with other stations, one of which may have a capacity of 500,000 kVA. An interesting feature of the oil circuit breakers is the method adopted of exhausting to the outside of the building any gas produced by the action of the breakers. The vent of each breaker is connected to a 6in. diameter exhaust pipe running the length of each switchboard, the two pipes being taken through the wall of the building, and non-return valves are fitted in the connections between the circuit breaker tanks and the exhaust pipes.

The isolating switches are of the slow-break knife type, fitted with hold-on catches and operated by insulated hooksticks. Switches of 300, 800, 1500 and 3000 ampères capacity are installed. The outgoing feeder switches have one earth contact per phase. The current transformers are of the air-cooled tube type, with the primary windings enclosed in porcelain, except at the ends, the mechanical construction being exceptionally robust. The potential transformers are of the oil-immersed type and are fitted with current-limiting resistances H.T. and L.T. fuses being provided on the control board. The primary windings are insulated with Bakelite. Together with their accessories, the potential transformers are accommodated in small self-contained trucks complete with automatically shielded isolating plugs at the bottom of the cubicles. All the instrument transformers on the new extensions are of Chamberlain and Hookham manufacture.

The main control board for the remote electrical control of oil circuit breakers consists of twenty-four panels controlling corresponding H.T. cubicles, a number of which are left blank for future extensions. Each panel is divided into three sections. The top section carries the indicating instruments; the middle section the oil circuit breaker controller indicating lamps, and a mimic bus-bar diagram; and the bottom section the integrating meters and protective relays. The switchboard is of the flat back type, consisting of enamelled slate panels with bevelled edges, secured to angle iron framework. The top section of each machine panel carries an ammeter and ammeter switch, a power factor indicator, and an indicating wattmeter for three-phase balanced load. The feeder panels and bus-bar coupler are equipped with an ammeter with a switch. On the middle section of each panel there is a two-way oil circuit breaker controller, and red and green indicating lamps to show whether the circuit breaker is open or closed. The mimic bus-bars are made of nickel-plated strip and have solenoid-operated indicators, the whole forming a single-line diagram showing at a glance to which set of bus-bars the isolating switches are connected. On the feeder panels an extension is provided to show whether the isolating switches on the feeder side of the oil switch are closed or open. The bottom section of each control panel for the alternators and feeders carries a watt-hour meter, a three-phase protective relay for the alternators only, a leakage relay, and a double-pole overload relay. The bus-bar coupler panel is fitted with two overload relays only, one single-pole and one double-pole. The watt-hour meters are of the Chamberlain and Hookham standard polyphase type for unbalanced loads. The design combines an extremely high torque with a very light moving element, low speed of rotation, and small losses in the windings, and it is said that the accuracy from full load down to one-fortieth of full load does not vary more than ± 2 per cent. The circulating current protective system is employed, and for the most part existing three-phase protective relays have been utilised. The 15,000-kVA of turbo-alternator circuit is, however, fitted with G.E.C. protective gear, in which a beam relay is employed. This system of protection, although forming only a small addition to the existing plant, is able to check continuously the condition of the circuits and isolate instantaneously any section in which a fault develops. The protective gear is arranged on the balanced circulating current system. Biassing is also employed, so that the sensitiveness automatically varies according to the load. Thus the insensitiveness that is necessary for stability at high overloads can give place to extreme sensitiveness at normal loads. The system is also selective, enabling the faulty section to be cut out without the use of time lags or auxiliary relays.

In front of the main control board the field regulation control gear for the seven alternators is arranged as shown in Fig. 2. At the top part of this equipment there are ammeters and voltmeters for reading the excitation current and voltage, and hand wheels for operating the exciter field regulators. For two of the turbo-alternators the exciter field regulators are provided with automatic field switches, and for each of the other machines there is an ordinary exciter field switch with discharge resistance. For five of the sets, variation of the main field is effected by means of motor-operated regulators, the controllers for which are fitted with the operating handles that are to be seen in Fig. 3. In the main field circuit of the 15,000-kVA alternator an automatic field suppression switch is inserted. It operates in conjunction with the protective gear and trips automatically as soon as the trip circuit of the machine oil circuit breaker is energised, so that the field of the alternator cannot be excited after a fault has occurred until the field suppression switch has been closed again. Current transformers are also installed for the circulating current protective system, and are mounted in the alternator pits, those for the 15,000-kVA sets being of the same design as those described.

In the case of five of the turbo-alternator sets, the turbine speeds are regulated by motor-operated governors, the governor motors being electrically controlled, and the controllers are operated by rotating knobs, which are mounted on the same pillars as the field regulation control gear, and are to be seen in Fig. 3. For earthing the neutral point of the alternators, 600 ampère non-automatic oil circuit breakers with resistance are fitted, each being enclosed in a sheet steel case. For the works power circuits little of the high-tension switchgear is new, existing apparatus having been used for the bus-bars, isolating switches, and oil circuit breakers. The current transformers, however, are new and are of the standard type similar to those previously described. The works power control board consists of six panels situated at the ends of the main control board, and comprise a works feeder panel, two 250-kVA transformer panels, two 500-kVA transformer panels, and one 1000-kVA transformer panel. The feeder panel and two of the transformer panels may be seen on the left of Fig. 2. Each control panel carries an ammeter, with a switch, an oil circuit breaker controller, indicating lamps, and protective relays. The feeder panel is fitted with protective gear consisting of a single-pole leakage relay and a double-pole overload relay. The five transformer panels are fitted with the G.E.C. protective system, the relay being a standard three-phase beam relay. The equipment of each transformer panel includes current transformers and a previously existing low-tension oil circuit breaker. A 300-ampère triple-pole rotary isolating link enables the works feeder to be connected to the bus-bars of one of the group feeders if required, and two similar links connect the works power switchgear to the works feeders. Further extensions, which are now in hand, comprise switchgear controlling two feeders for Erith, two for Bexley, and one for the Siemens works, the apparatus being exactly similar to that already installed.

For permission to publish this description we are indebted to Mr. G. W. Keats, the Borough Electrical Engineer.

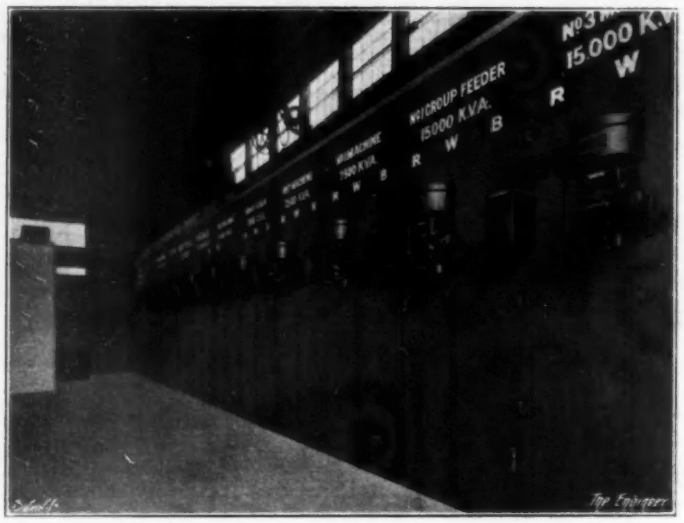


FIG. 1—6600-VOLT CUBICLE SWITCHBOARD

FIG. 2—REMOTE-CONTROL BOARD

FIG. 3—REMOTE-CONTROL BOARD AND FIELD REGULATORS

The Quarter's Shipbuilding Returns.

FROM the statistics issued by Lloyd's Register of Shipping regarding vessels under construction at the end of June, we note that in Great Britain and Ireland there was a decrease of 138,211 tons in the work in hand as compared with the figures for last March, and that the present total —555,603 tons—is 836,460 tons less than the tonnage which was being built at the end of June, 1930. Moreover, the figure for June, 1931, is lower than that for any quarter since December, 1887, and includes nearly 68,000 on which work has been suspended. Nearly 82,000 tons of the tonnage now in hand in this country are intended for

Norway, and about 86,500 tons for other countries abroad or for sale.

The tonnage now under construction abroad—1,270,384 tons—is about 36,000 tons less than the work which was in hand at the end of March, 1931. Six countries abroad have more than 100,000 tons under construction, viz.:—United States of America, 301,489 tons; France, 211,940 tons; Italy, 170,658 tons; Germany, 130,651 tons; Sweden, 110,355 tons; and Holland, 108,299 tons.

The total tonnage under construction in the world amounts to 1,825,987 tons, of which 30·4 per cent. is being built in Great Britain and Ireland, and 69·6 per cent. abroad. The average percentages in the last twelve months before the war were 57·2 for Great Britain and Ireland and 42·8 for abroad.

In Great Britain and Ireland only 23,359 tons were begun during the last three months, a decline of 9326 tons from the corresponding figures for the March quarter. For the purpose of comparison it may be stated that during the six months ended March, 1930, the monthly average of tonnage begun was over 154,000 tons. During the second quarter of 1931, 170,100 tons were launched, an increase of about 25,000 tons as compared with the quarter ended March 31st last. Similar figures for abroad are 211,079 tons begun, and 302,050 tons launched, showing increases, as compared with the previous quarter, of 1896 and 50,197 tons respectively.

The oil tankers under construction in the world amount to 77 vessels of 627,810 tons, of which 28 vessels of 243,315 tons are being built in Great Britain and Ireland, 11 vessels of 85,100 tons in Sweden, and 9 of 82,090 tons in Germany. It is noteworthy that of the 77 tankers under construction, 67 are motor ships. The tanker tonnage now in hand represents over 34 per cent. of the total steam and motor tonnage being built in the world.

During the first three quarters of 1930 the tonnage of motor ships under construction in Great Britain and Ireland exceeded that of steamers being built, but at the end of December steamers again exceeded motor ships by 23,740 tons. At the end of March, 1931, the steam tonnage being built—395,352 tons—was 100,000 tons more than the motor tonnage, while at June 30th last the steam tonnage being built in Great Britain and Ireland exceeded that of the motor ships by 126,301 tons. The motor ship tonnage being constructed abroad—657,304 tons—is 47,805 tons greater than that of the steamers.

Of the vessels being built in the world at the end of June, there are 4 steamers of between 8000 and 10,000 tons, and 7 of between 10,000 and 15,000 tons, while the motor ships amount to 29 and 14 respectively. Of the larger vessels, *i.e.*, those of 15,000 tons and upwards, however, 12 are steamers of between 15,000 and 30,000 tons, and 7 are steamers of 30,000 tons and upwards, while there are only 4 motor ships in the former division, and none in the latter.

The table respecting marine engines shows that the horse-power of steam engines now being built or being fitted on board amounts to about 1,182,000 horse-power, while the figures for oil engines aggregate about 797,000 horse-power. The figures for steam engines include fifty sets of turbine engines of about 1,037,000 shaft horse-power, giving an average of 20,736 horse-power per set. The horse-power of the steam reciprocating engines—145,065 horse-power—is less than 7·5 per cent. of the total horse-power of marine engines now building in the world.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(*From our own Correspondent.*)

No Improvement.

Last week's Quarterly Meeting of the Midland iron trade did practically nothing to improve the position of industrialists in this area. There was little buying of iron and steel, and few contracts were entered into. Consumptive demand showed no sign of expansion, and reports from consuming industries were not at all reassuring. During the past week there has been slightly more buying of finished steel, which was due to a release of orders held up pending the Steel Association's decision regarding prices, though consumers are, naturally, disappointed that a reduction has not been made. The heavy trades hereabouts remain dull, and in the main engineering business is slow; even the automobile branch is falling away and suspension of employees has become necessary. Sheet metal firms and others engaged upon subsidiary work for the trade are correspondingly quiet. Manufacturers of bedstead tubes report an improved demand from export sources, but in other departments of Staffordshire industry inquiries and business is stated to be scarce.

Steel Prices.

Consumers of finished steel who had anticipated a lowering of the fixed selling rates as a result of the reviewing of the position by the Associated Steelmasters, have again been disappointed. Last week-end it was announced that the Association had decided to reaffirm prices at the recent level. Some disappointment is felt that values should be so upheld, for it is claimed they are not in relation to those of other materials which have fallen considerably, while finished steel prices have been maintained. Selling rates have not been changed since December, 1929, except that in January last the difference in favour of the consumer using British steel only was increased. There has been a marked decline in values of billets, bars and strip, selling prices of which are not subject to control, while all descriptions of foreign steel have depreciated. The Association's decision was quite an unpleasant surprise to Midland users, who had anticipated either a reduction in the rates or an increase in the preference given to participants in the rebate scheme. The rates for delivery in the Midland area thus remain: Angles at £8 7s. 6d., less 15s. rebate; joists, £8 15s., less 22s. 6d. rebate; ship, bridge and tank plates, £8 17s. 6d., less 15s. rebate. Engineers and other consumers in this district are largely pledged to the Steel Association, but the continental quotation of £4 10s. per ton for joists is proving a severe temptation to some of them. There was some release of business this week, users being assured that there was nothing to be gained by further withholding orders. It was related, however, only to suppliers required for current consumption. There is little movement in other classes of steel. Boiler plates are slow of sale at £9 per ton, small bars re-rolled from continental raw material make £6 7s. 6d. to £6 10s., all-British bars are £7, mild steel billets £5 upwards, and Staffordshire hoops £9 10s.

Pig Iron.

There has been no movement of importance in the raw iron trade during the past week. Demand is poor, but steady, and output is just about being consumed. A North Staffordshire plant is closing down this week, thus relieving the situation to the extent of probably 600 or 700 tons a week, and there is talk of another Midland furnace going out of commission in the near future. Efforts being made by consumers of pig iron to induce furnacemen to accept lower prices meet with no success. It is held, on the part of the combined smelters, that production costs do not permit of any lowering of selling rates of iron. Users point out that fuel costs have come down considerably—they are now about the same delivered at furnaces as they were at the beginning of 1914—and contend that iron prices should be reduced accordingly. There seems to be little probability of a lowering of rates just now, however, and the Producers' Association is in a strong position, so that there is little prospect of getting spot lots cheap. Foundrymen in this area are not well placed for work, and they are buying small tonnages as required. Forges make but small demands upon smelters. Derbyshire and North Staffordshire No. 3 foundry iron sells at £3 6s., forge at £3 1s., and Northamptonshire foundry at £3 2s. 6d. with forge £2 17s. 6d.

Finished Iron.

Only a small proportion of the available plant for making finished iron is in operation in Staffordshire. There have been no developments since I last wrote, and although it is confidently believed that wrought iron will receive more consideration and become in increasing demand as compared with steel when trade revives, it receives little support at the moment. The railways, collieries and engineering firms which habitually make use of marked bar iron are at date unable to consume their normal quantities. Prices are stationary in all departments. Strip is in slightly better request, but values remain at £10 12s. 6d. per ton delivered. Marked bars are quoted £12, Crown quality £9 5s., and common bars £8 10s. delivered.

Blast-furnaces to be Closed.

The blast-furnaces associated with the Stafford Coal and Iron Company's undertaking at Great Fenton, Stoke-on-Trent, are being closed down this week. The cause, as given by Sir Francis Joseph, a director of the company, is the fall in the price of pig iron, which renders it economically impossible to operate the blast-furnaces, and that is due to unrestricted foreign competition. "Pig iron is being dumped into this country in huge quantities from France, Belgium and Germany," said Sir Francis, "and is being sold below the price charged to home manufacturers in those countries. Pig iron has fallen steadily in price during the past 18 months in consequence of this dumping, and in view of the heavy losses already sustained, the directors have reluctantly been compelled to close down the blast-furnace plant." Until recently at this establishment one furnace had been operating on forge and foundry iron and another on basic pig.

A Successful Year.

Henry Hope and Sons, Ltd., manufacturers and engineers, of Halford Works, Smethwick, are to be congratulated upon having had a profitable trading year, upon their strong financial position and upon their enterprise in keeping their plant up to date. Notwithstanding the world depression and the general reduction in prices, the firm's sales for the year constitute a record in its history. This success has entailed much work, because the firm has been obliged to manufacture and sell a greatly increased tonnage to achieve the result. If it had not been for losses sustained by three of their subsidiary companies abroad, the large turnover would have been more adequately reflected in the profits. The balance of profit available, together with the balance from last year's accounts, amounts to £82,132. An answer to the statements made in some quarters that British manufacturers are not keeping abreast of the times, as regards machinery, is provided by the record of this firm, which, during the past twelve months, has spent over £30,000 in new machinery and plant and the rearrangement of old plant.

June Trading.

June produced a new low record of exports, and showed clearly that the slump in overseas trade is unchecked. The month proved one of the worst for many years past, and that the Midlands, in common with other manufacturing areas, had to bear its share of the decline is evident. The reduction in the export of articles wholly or mainly manufactured amounted to £12,105,811, the main contributors to this total being iron and steel manufactures thereof, £1,746,058, machinery £1,210,361, vehicles, including railway stock, ships and aircraft, £3,164,053, and cotton yarns and manufactures £1,931,790. It is noteworthy that while the decrease in imports of £14,710,270, as compared with June twelve months ago, is spread over practically the whole field of trade, the decline of £13,413,441 in British exports is nearly all confined to articles wholly or mainly manufactured. Iron and steel imported last month amounted to 246,334 tons, compared with 214,504 tons in the corresponding month of last year.

Cheaper Electricity.

Owing to satisfactory trading during the past year, the Wolverhampton Corporation electricity undertaking announces a rebate of 5 per cent. to power users, and a reduction of approximately a similar amount by a consolidation of the Coal Clause—for next year. During the past year there was a falling off in consumption of electricity for power purposes of something like 8 per cent. About 80 per cent. of the undertaking's supplies went to industry last year, and the necessity for providing cheap power is recognised by the responsible Committee.

Trade with South America.

Black Country manufacturers, traders and members of the Chamber of Commerce are to hold a private conference with Lord Ednam on the 27th inst., to discuss what can be done to get a larger share in the South American markets for Black Country goods.

Fire at Black Country Works.

A fire causing damage, estimated at several thousands of pounds, to machinery, which has thrown out of work for two or three weeks about 100 workpeople, occurred on Friday last at the works of Charles Homes and Sons, Ltd., nail manufacturers, &c., Hawne-lane, Halesowen.

Unemployment.

There has been a welcome decline in unemployment in the Midlands area during the past week, the total figure having fallen from 425,637 to 399,573. There are still, however, 115,338 more workless than there were at this time twelve months ago. In the Birmingham area unemployment continues to increase, and to-day's total of 69,728 compares unfavourably with the previous week's of 69,306. It is notable that at about this time of last year the total for the Birmingham area stood at 28,531, while in 1929 the number of unemployed at the beginning of July was 15,659. At Coventry, also, the figures continue to grow, and now stand at 17,342. With the exceptions of Wednesbury, Walsall and Bilston, the Black Country towns again record increases on the week. Of the total unemployed in the Midlands area 275,201 are men, 108,584 women, 8110 boys and 7678 girls.

Obituary.

The death took place on the 8th inst. at Wolverhampton of Mr. William Tonks, managing director of Samuel Tonks and Sons, Ltd., brass and bell founders, of Church-street, Wolverhampton, one of the oldest businesses in the town. Mr. Tonks, who was well known and highly respected in Midland industrial circles, was in his 92nd year.

LANCASHIRE.

(*From our own Correspondents.*)

MANCHESTER.

Dwindling Markets.

IN no month since the depression made itself felt in the export trade in British textile machinery have shipments been at so low a level as in June. In that month the total value was £389,173, compared with £754,926 in the corresponding month of 1930, and £858,726 in June, 1929, the respective quantities being 25,730, 50,182, and 65,027 tons. Needless to say, every market shows a very serious falling off. British India, with takings valued at £121,908 during the month, still heads the list, followed by China with £36,612, France with £32,708, South America with £31,862, Russia £15,435, Germany £12,804, the United States £12,103, the Netherlands £10,732, Japan £9003, and Australia £2511. In the aggregate, exports to "other European countries" amounted in value to £62,246. For the first half of the present year shipments have been 25,730 tons, valued at £2,587,210, against 50,182 tons and £4,819,816 in 1930 and 65,027 tons and £5,874,447 in 1929.

Steels for High Pressures.

An interesting memorandum on the behaviour of steel at high pressures has been issued to members of the Manchester Steam Users' Association. Mr. V. B. Harley-Mason, general manger and chief engineer of the Association, comments on the fact that since the war there has been an insistent demand for greater economy in the production of power, which is being accentuated at the present time by the world-wide economic depression. In consequence of the increase in the pressure and temperature at which steam is being used, boilermakers have been driven to construct boilers for pressures which would have been considered fantastic a few years ago. In Mr. Harley-Mason's opinion the temperatures of superheated steam have now reached the limits imposed by existing known standards. In view of the fact that there is no competitor in sight, steel is likely for many years to come to remain the mainstay of boiler work, although every year it becomes increasingly necessary to differentiate between the many new "steels" that are making their appearance.

Additions to Order Books.

The Metropolitan-Vickers Electrical Company, Ltd., of Trafford Park, Manchester, have received a repeat order from the Victoria Falls Power Company, South Africa, for a 26,000-kW turbo-alternator condenser set of the value of £104,000. In connection with the ventilating plant for the new Mersey Tunnel running from Liverpool to Birkenhead, the Mersey Docks and Harbour Board has placed an order for sixteen large-size fans, similar to those which the company have manufactured for installation in collieries in this country and abroad, with Walker Bros., Ltd., Wigan. From other sources that firm has also secured contracts for air compressors.

Waterless Gasholder Starts its Career.

A new waterless gasholder of 5,000,000 cubic feet capacity, which has been erected at a cost of £56,000 at the Bradford-road gasworks of the Manchester Corporation, was officially put into operation on Friday of last

week by Alderman Cook, an ex-Chairman of the Gas Committee. The new holder is 250ft. in height.

Setback in Non-ferrous Metals.

All sections of the non-ferrous metals market during the past week have registered a net decline, but copper has been the principal sufferer, for tin, lead and spelter are all still well above the figures at which they stood before the Hoover announcement some weeks ago sent them moving upward. Tin, however, stands out as having experienced the widest fluctuations since last report. Fairly active buying operations at one time sent up prices to appreciably higher levels than were current a week ago, and a welcome feature was the fact that, contrary to the customary experience for some time of rising stocks, these were actually slightly lower than they were at the close of the previous week. The inevitable reaction set in, however, and, acclerated in the early part of the present week by the financial troubles in Germany, values have rapidly tumbled down until at the time of writing they are roughly £8 a ton below those ruling at last report. Outside influences have also played their part in depressing the copper market, although the unfavourable statistical situation is the outstanding adverse factor. Standard brands have lost on balance about £3 a ton, and the whole of the recent gains has been more than wiped out. The fall in lead, at about 15s. a ton, has been relatively severe, but a fair weight of business has been placed. Spelter, also, has attracted some attention, and in this section the week's loss has been smaller than in any other.

Iron and Steel.

Apart from pig iron, little animation can be reported in respect of the iron and steel markets here. Derbyshire sellers continue to report somewhat better sales of foundry iron, due, as before, more to a movement to replenish stocks than to any real improvement at the consuming end. Having regard to the fact that the holiday season in Lancashire is almost at its height, sellers express themselves as reasonably well satisfied with the course of events. The demand for bar iron, however, continues unsatisfactory, although prices keep up at £9 15s. per ton for Lancashire Crown quality and about £8 5s. for seconds. Steel rollers this week have not been very hopeful that, in the present state of users' order books, the forward buying movement, so long absent on this market, will be set going again in consequence of the decision of makers to maintain the range of values. Neither constructional engineers nor locomotive builders in the district are operating beyond immediate requirements, and these amount to comparatively little in the aggregate. With the exception of small bars used for bright drawing purposes, which are selling in moderate quantities, the bar trade is quiet. Current quotations are on the basis of £9 per ton for acid and basic boiler plates, £8 17s. 6d. for general plates, about £6 10s. for small re-rolled bars, £9 7s. 6d. for large bars, £8 7s. 6d. for sections, and £8 15s. for joists. Keen selling competition in the market for imported materials, principally from merchant holders, is having an unsettling effect on prices.

BARROW-IN-FURNESS.

Hematite.

There was a significant move during the week-end in the hematite pig iron market, prices having been reduced to the extent of several shillings. This reduction may be dictated by a desire to meet competition and attract buyers to take bigger tonnage, but another important factor may be the heavy stocks which are still carried in the district. Despite restriction, the fall in stocks has not been considerable where production continues. In the case of the Barrow works, the furnaces being damped down, all orders have been delivered from stock for some weeks. One thing is certain, the present prices of pig iron are well below actual cost by several shillings. Business with the Continent is dull and the same remark applies to American trade, shipments last week being on home account. The iron ore trade is dull and the demand for native ores is very quiet, and foreign ore is 2s. a ton cheaper than it was. The steel trade is very quiet and the rail mills at Barrow are still doing nothing. Hoops and small sections are better situated. Fuel is in moderate demand. Shipping is very dull.

SHEFFIELD.

(From our own Correspondent.)

Statistics of Production.

THE official returns of steel production for May show some improvement in this district over the previous month, but it is more apparent than real, as April included the Easter holiday stoppage. The difference between May this year and May last year is very striking. In the most recent month, the output of steel ingots and castings in the Sheffield area was 63,500 tons, compared with 46,500 tons in April, and 83,400 tons in May, 1930. In Lincolnshire, the production was 32,800 tons in May last, as against 20,500 tons in April, and 57,000 tons in May of last year. Lincolnshire also produced in May 35,100 tons of pig iron, the comparative figures being 29,900 tons in April and 76,100 tons in May last year. Thus, the pig iron production of that district has fallen by more than 50 per cent. on the year. The local areas are not alone in this plight, as other iron and steel districts in the country record equal or even greater falls.

The Present Position.

There is no improvement to report in Sheffield conditions, nor anything in the outlook to stimulate hopes of early progress. Open-hearth production is still on an exceptionally low scale, and, although orders come in with a fair amount of regularity, they are but small, and only just suffice to keep a few furnaces going. The large orders, which would justify the lighting of more furnaces, are still wanting. The railway departments are working much below capacity on axles, tires and springs, and will greatly welcome the work on Chinese Boxer Indemnity account, which, although it has been expected for some time, has not yet been placed. The call for shipbuilding steel remains very poor, though the departments producing hollow forged drums for power-house and other boilers maintain a fair amount of activity.

Special Steels and Tools.

There is a large production of special steels of the stainless, acid-resisting and heat-resisting varieties, for many purposes, and that department is still one of the strongest in the whole range of Sheffield trades, but it would appear that a halt has been called in the progress that it has been making for a considerable period. Thos. Firth and Sons, Ltd., who have hitherto carried on the melting of stainless steel at both their Tinsley and Norfolk works, Sheffield, have now decided to concentrate that operation at the Norfolk Works, following upon the installation there of a big 20-ton electric furnace. Some of the space released at Tinsley by the discontinuance of electric and crucible furnaces will be used for a large mill which is to be erected for hot-rolling stainless sheets. The call for automobile supplies is still considerably below the level of a couple of years ago, and several firms are feeling the difference rather seriously. Among the products affected by this decline are permanent magnets, but the magnet makers are still comparatively busy on the production of magnets for other purposes, and that section is probably the only really healthy one on the finished side. A very useful trade is being done in special alloy steels for aeroplane work in which several firms specialise. The tonnage called for is not large, but the material is expensive, and the trade is valuable from the monetary standpoint. Business in tools generally continues on the meagre level of the last four or five months, and with few exceptions the factories are very short of work. While there is a fair demand for engineers' tools and tool steel from the home market, the exports have dwindled to very small proportions.

A Local Amalgamation.

The proposed acquisition of the business of William Cooke and Co., Ltd., by the Templeborough Rolling Mills, Ltd., to which I referred a week or two ago, is being carried through. It is announced that the offer of the Templeborough Company has been accepted by more than the requisite percentage—90 per cent.—of each class of shareholder. All operating departments of William Cooke and Co. will be continued as at present.

Company Results.

The United Steel Companies, Ltd.—the new company which was formed last year to acquire the undertaking and assets of the old company of the same name, together with those of United Strip and Bar Mills, Ltd.—has issued a circular to shareholders stating that, although profits were earned during the twelve months ended June 30th last, they are not sufficient to enable the directors to recommend the payment of a dividend. A depressing report, emphasising the bad conditions from which the engineering industry has suffered during the past year, has been issued by the directors of Davy Bros., Ltd., one of the best-known Sheffield firms. The trading for the year ended March 31st last resulted in a loss of no less than £42,488, increasing the debit balance forward to £88,261. The directors state that the unsatisfactory trading results are entirely due to the shortage of suitable work from the company's regular customers, particularly in this country, and the little work available has had to be accepted at low prices. I have already reported that Sir William Ellis, who had been chairman of the company since 1919, resigned from the board at the end of last year, and that Mr. Edmund J. Fox, of the Stanton Ironworks Company, was appointed to succeed him. The present report mentions that Mr. A. J. Capron, who has been managing director of the company for 30 years, has relinquished that position, although he retains his seat on the board.

A New Mining Appliance.

The Mining Appliances Company, of Dronfield, near Sheffield, has opened large and important extensions of its works, which have been carried out with the view of manufacturing an entirely new electrical driving gear. Specially designed and constructed machines have been installed, and production on a large scale wll begin immediately. The gear is entirely British. The gear-box is devoid of ordinary gear wheels, and that, in conjunction with the extraordinary design of the reciprocating parts, makes, as a whole, a machine of great utility. It is claimed that the machine has special advantages in connection with coal output. It travels from 12in. to 18in. per stroke and is practically silent in action, being regarded, therefore, as a boon to the miner. All parts of the machine are encased and run in oil baths, so that the wearing parts will have long life.

Municipal Schemes.

The Kirkstall generating station of the Leeds electricity undertaking was formally opened last week by the Earl of Harewood. It has cost £800,000, and will serve as a base loading station under the Electricity Board's Mid-east England scheme. It is recommended that the tender of Messrs. Armitage and Hodgson, of Leeds, be accepted for the erection of the new civic building in that city. The price is £223,000. The scheme of Hull Corporation for erecting baths in Albert-avenue, at an estimated cost of £40,880, has been approved for grant by the Unemployment Grants Committee. The Beeston Urban Council, Notts., has erected a bridge at Humberroad, South Beeston, which will connect with the new arterial road that it is proposed to make from University Boulevard through Chelwill and Attenborough. The bridge is mainly of steel, was built by Swift Bros. and Haslam, Ltd., of Doncaster, and at present leads to the Beeston sewage works and to the new factory. Boots Pure Drug Company, Ltd., which contributed £10,000 of the total cost of £23,000, the balance being provided by the Unemployment Grants Committee.

NORTH OF ENGLAND.

(From our own Correspondent.)

Cleveland Iron Trade.

DISQUIETING financial conditions on the Continent have assisted further to depress the Cleveland iron and steel market. A cheerless tone has quickly followed the slightly better feeling noticeable last week, and customers are again markedly disinclined to commit themselves beyond parcels of material sufficient to cover pressing requirements. Holiday influences in Scotland are also retarding business, but the inability of the Cleveland ironmasters to find outlets for the disposal of the whole of the make of iron is in no small measure due to the fact that it it is not at a competitive price. Ironmasters offer concessions in Scotland, but still cheaper iron is on offer in that area from other sources, and elsewhere Cleveland iron is still quoted at the fixed prices which have ruled since the beginning of the year. These prices, consumers insist, are too high, and in many instances they are using iron from other areas. Midlands iron, in particular, is now being extensively used on Teesside. Nevertheless, Cleveland prices are unchanged, No. 1 foundry being 61s.; No. 3 G.M.B., 58s. 6d.; No. 4 foundry, 57s. 6d.; and No. 4 forge, 57s.

Hematite Pig Iron.

In the East Coast hematite pig iron trade business continues to taper off in disappointing manner. Buyers state they are able to shade market rates, though the belief is stronger that further material fall in values is unlikely. Hematite is cheap compared with prices ruling for Cleveland pig iron. Makers are doing a small steady trade with customers in the Sheffield district and in the Midlands. Odd orders from abroad secured by merchants are obtained only by severe price cutting. Ordinary qualities of hematite keep at 62s. 6d., and No. 1 remains at 63s.

Ironmaking Materials.

Nothing new of moment is ascertainable concerning the foreign ore trade. With the exception of sales of spot lots, business is virtually at a standstill. The nominal price of best Rubio is 15s. c.i.f. Tees. Blast-furnace coke is still plentiful, but sellers are inclined to adopt a rather firmer attitude. On the other hand, ironmasters are buying little and state they can still cover their needs at the equivalent of good average qualities at 15s. delivered at the works.

Manufactured Iron and Steel.

There is keen disappointment in this district over the decision of the associated steel makers to maintain unchanged the fixed prices for plates, joists and sections. The decision was not wholly unexpected, as makers had already claimed that they were not in a position to offer further concessions. Nevertheless, buyers had built up hopes that some reduction would be made, and certain shipbuilders have hinted that they may now withdraw from the rebate scheme. However, for good or ill, all doubts regarding prices are removed, and it is hoped that a few orders may be realised. Meanwhile, the works are moderately employed, but it is admitted that overseas business is quiet.

The Coal Trade.

The Northern coal market is very quiet just now, and the uncertain financial outlook on the Continent causes shippers to act warily. New business comes forward slowly from all continental centres, and under old contracts merchants find difficulty in getting their foreign consumers to take full commitments. The export of coal to Portugal from this district is not a large one, but the recent increase of port charges on coal cargoes entering that country is causing anxiety to exporters. An effort is being made to get the Foreign Office to press for exemption of old contract sales from the new impost, which amounts to about 7d. a ton increase. The present output of coal of every description in the Northern Counties is little above the minimum contract commitments, as there is virtually no new business circulating. Many owners, even under the general restriction of output, still find it necessary to curtail production by further odd days' idle time. Local exporters believe that a system of import licences for coal into France is now certain. It would appear that the French Government is anxious to diminish the quantity of coal imported in the hope of lessening unemployment at the French coal mines. All the large undertakings are to be asked to utilise national coal to the extent of three million tons more than has hitherto been used, and to give French collieries an equivalent amount of trade. If the imports are reduced by three million tons the North-East Coast would be affected to the extent of about half-a-million tons. In these difficult days it would be a further substantial loss in business to this area. There is little change in the Northern steam coal trade. All descriptions are in good supply, although some brands are difficult to get hold of owing to the owners having fully sold out to their maximum quota allowance. There is, however, no general scarcity of any group. Best Northumberland steam coals are unaltered at 13s. 6d., with seconds at 12s. 6d. Steam smalls are in a little better request, but there are still vast accumulations in Northumberland. Gas coals are in curtailed production and still the supply exceeds the demand. It is usual to experience dull trade in July, but this year the market is much quieter than usual. Best Durham gas coals are quoted at 14s. 6d., and secondary kinds at 13s. to 13s. 3d. Coking coals are in slow sale, but bunkers for early use are brisker. Although the demand for coke is rather on the slow side, makers are taking a favourable view of the prospects, and are not forcing the market. Prices asked are a shade steadier than recently. Patent oven qualities are at 15s., and superior foundry at 17s. to 20s. Gas coke offers at 18s.

Cleveland Miners' Wages.

The wages of Cleveland ironstone miners are to remain unchanged for a period of at least three months.

That was the decision reached by the owners and the men's representatives at a conference this week. In accordance with the usual formula, the ascertainment of pig iron prices for the past quarter gave the owners the right to reduce wages. Sympathising with the position of the miners, whose earnings are low and who often work short time, the owners generously decided to forego the advantage and to allow rates of pay to remain at their present level.

Giant Floating Dock.

The 17,000-ton floating dock built by Swan, Hunter and Wigham Richardson, Ltd., Wallsend, for the Wellington Harbour Board, New Zealand, left the Tyne this week on its long journey of over 13,000 miles to its destination. The dock, which was built and launched in three sections, is being towed out as a complete whole by powerful Dutch tugs. The tow, which will be *vid* the Suez Canal and the Torres Straits, will be the longest on record and is expected to last seven months. The total length of the dock is 584ft. and width 117½ft., and although not the largest built by Swan, Hunter and Wigham Richardson, it is of the most up-to-date description as regards equipment, &c. It has a lifting capacity of 17,000 tons.

SCOTLAND.

(From our own Correspondent.)

Markets Inactive.

BUSINESS in steel, iron and coal continues inactive. Since the American debts proposals a better tone has prevailed, and inquiries have been more numerous, but definite business has not increased to any extent. Even the possibility of a stoppage in the coal mining industry has failed to bring out extra business. Generally speaking, efforts are mainly confined to clearing off deliveries prior to the beginning of the annual holidays, which will be observed from now until the end of the month and probably during part of August.

Steel.

Inquiries for steel have shown some slight increase, but no expansion in business can be expected until well on into the autumn, and even then the extent of activities may depend to a considerable extent on the accumulation of orders during the holiday season. The production of heavy steel continues at a rate far below capacity, demands from all quarters being restricted. Some business may have been held up pending the result of the steel makers' meeting. If lower prices were hoped for, consumers must be disappointed at the result of that meeting, which upheld present rates and did not come to any decision on the question of rebates, the current levels of which are due to be continued or revised. Home demands for black sheets are poor. There is a better inquiry for galvanised sheets for export, with the price at £10 to £10 5s. per ton f.o.b. Glasgow for corrugated sheets, 24 g. Tubes are slow, but better orders from New Zealand and Australia are expected in the near future.

Iron.

Along with other departments of industry, iron-makers and steel re-rollers anticipate some benefit from the proposed debts moratorium. An improvement in those branches is long overdue, and any advancement will be most welcome. Iron bars have suffered from the lower cost of steel and reduced export demands, while re-rolled steel bars are faced with stern competition from abroad. Bar iron is unchanged in price and re-rolled steel bars are quoted £6 5s. home and £6 2s. 6d. per ton export. Only six pig iron furnaces remain in action, but supplies are ample. Considerable quantities of material are still being imported, thereby adding to the difficulties of the local producer. Last week shipments of pig iron from Glasgow only amounted to 66 tons, compared with 723 tons—418 tons foreign—in the same week last year.

Scrap.

The demand for scrap is somewhat uneven and prices continue round about 49s. 3d. for cast iron machinery and 37s. 6d. per ton for heavy steel.

Coal.

Despite the possibility of a stoppage in the industry, there has been an almost entire lack of extra demand for supplies. Inquiries received from foreign countries have not increased, and business on the whole is confined to small lots due for shipment before the holidays. The collieries are not quoting ahead and exporters are not disposed to take any risk, not only in face of the possibility of a stoppage in the coalfields, but also the ton production quota fixed for the third quarter of the year, which has already resulted in a further curtailment of activities in some districts. Business as a rule is in a state of suspension until a definite decision is arrived at on the terms of employment in the industry. Aggregate shipments amounted to 221,250 tons, against 237,273 tons in the preceding week and 226,345 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

The Coal Trade.

THE conditions in the steam coal trade last week were certainly very bad, as the figures relating to shipments only too plainly show. According to the returns of the Great Western Railway Company, the total for the six ports in this district under its control, which includes Swansea and Port Talbot, where anthracite coals are mainly shipped, came to only 396,900 tons, which compared with 483,000 tons for the preceding week, and with 510,230 tons for the corresponding period of last year. Last week's total was, in fact, the lowest for any normal week of this year. The inactivity prevailing at the docks will be further realised when it is stated that at the end of last week there were as many as 64 idle tipping appliances at the various docks. The position of the docks in this respect has not been worse this year, except in January, when, owing to strike troubles, operations at the docks were reduced to a negligible scale. It naturally follows that the collieries have had a very difficult time, and numerous undertakings have not been able to work anything like regularly as the result of the accumulation of stocks and the shortage of wagons. Arrivals of tonnage over the week-end improved the situation to some extent, but even on Monday the total of idle appliances was as high as 45 and there were only three steamers waiting to get into berth. It cannot be denied that the position of trade is very unsatisfactory, and, unfortunately, there is no prospect of any improvement until the autumn at the earliest. News is now definite that the French Government intends to introduce a system of licenses similar to that adopted in 1927, in order to control the importation of coals and so aid French collieries, but, as mentioned last week, there is not the alarm that was at first entertained regarding the effects of this step, though it is, perhaps, as well to await official details respecting the scheme before forming definite opinions. Current demand is particularly slow, but, in the case of contract operations, it is now reported that T. Beynon and Co., Ltd., whose price was 24s. 5½d. per ton c.i.f. Alexandria, have received the Egyptian State Railways order for 100,000 metric tons of locomotive coals for delivery over the next four months. There is no news, however, that these railways have bought any coals on an f.o.b. basis, though they asked firms to quote on a c.i.f. as well as a f.o.b. basis. The order for 100,000 tons is, of course, very welcome, but the competition from continental coals is as intense as ever, and it is to be regretted that in the case of the recent inquiry from the Swedish Naval Administration for 20,000 tons of best Admiralty large coals for early shipment, local firms were not so successful. The order has, in fact, been captured for Westphalian coals at prices a shade less than were quoted for Welsh coals. Another interesting inquiry on the market for which prices have had to be sent in this week is for 50,000 tons of steam coals for the Brazilian Central Railways to be delivered at Rio de Janeiro. There is no doubt that the Germans will make a great effort to secure that order, in connection with which the terms of payment are a not unimportant consideration.

Portuguese Gold Decree.

Reference was made last week to the consternation caused in coal exporting circles by the sudden announcement of the Portuguese Government abolishing the Gold Decree and the effect it would have of imposing higher port duties on tonnage trading to Portuguese ports, this increase being equivalent to 7d. per ton, except in the case of steamers belonging to approved nationalities, which benefit by a 25 per cent. reduction. This order was made to apply from the 1st inst., which served the more to complicate the position, but the excitement died down towards the end of the week, and troubles look as if they are being smoothed out. News has been received that importers in Portugal and other interested parties have had a meeting to discuss the situation, and have agreed to enforce the new decree, which means that so far as any new business is concerned, they will take into consideration the fact that higher rates of freight will have to operate to compensate owners for the increased dues which they will have to pay. So far as concerns existing charter parties relating to single cargoes and to contracts for tonnage over a period, one of the largest exporting firms to Portugal—Gueret, Llewellyn and Merrett, Ltd.—has announced that it has decided to respect these contracts, which means that the shipowners will only be liable for charges which they would have incurred had the new decree not come into operation.

North Wales Coal Audit.

For the month of May the audit for the North Wales coal industry shows a debit balance of £3219, or 2·88d. per ton, compared with a debit balance in April of £906, or ·82d. per ton, and with a credit balance in March of £2969, or 2·37d. per ton. The production of coal in May was 267,704 tons, as against 264,720 tons in the previous month. The pithead proceeds per ton averaged 12s. 10·36d., compared with 13s. 0·25d., and the costs of production 13s. 1·24d., compared with 13s. 1·07d. The output per man shift worked was 18·34 cwt., compared with 17·94 cwt. in April, and the average wage per man-shift worked 9s. 4·43d., as against 9s. 3·15d. Wage costs per ton were 9s. 1·53d., compared with 9s. 2·54d., and costs other than wages, 3s. 11·71d., compared with 3s. 10·53d. The economic wage certified was only 1·74 per cent. above the basis rates, but under the present agreement the minimum rate is 22 per cent. above the base rates, and the deficiency arising from the payment of this minimum percentage amounted to £74,068, bringing the total deficiency carried forward to £4,061,241.

Coalfield Items.

By a majority of almost two to one, South Wales, through its lodges, has accepted the peace terms embodied in the New Coal Mines Act. This result was made known on Friday last at a meeting of the South Wales Miners' Federation executive, held at Cardiff. About 2000 men employed by the Tredegar Iron and Coal Company have received fourteen days' notices to terminate their contracts, though hopes are entertained that before the expiration of that period trade will justify the management in re-engaging some of the miners. Trade depression is also responsible for notices being issued to a number of the workmen at the Blaenavon Company's Big Pit and Firge Slope collieries. Reference was made recently to the settlement of the dispute which had been responsible for the idleness at the Bedwas collieries. A considerable number of men actually restarted, but there was quickly trouble again on the question of the seniority rule, though hopes are entertained that this will be overcome amicably shortly so that the men can again resume operations.

Tin-plate Items.

The mill department of the Old Castle Tin-plate Works had been idle for about a fortnight owing to a dispute, but the men concerned decided to resume operations on the conditions prevailing prior to the dispute, on the understanding that the American mills are not resumed until there have been further negotiations on working methods. The works restarted on Monday with operations at six mills, and it is likely that additional mills will be put into commission later. Mr. H. C. Bond was re-appointed last week as chairman of the employers' side with Mr. W. R. Hallowes as vice-chairman, while Mr. Ivor Gwynne was made chairman of the workmen's side with Mr. Morgan R. Rees as vice-chairman, when the the annual meeting was held of the Welsh Plate and Sheet Industry at Swansea. According to the official report, Mr. Bond made an earnest appeal to all concerned in the industry to do their utmost to maintain their present trade against the severe competition prevailing, and he further stressed the importance of keeping costs of production down to the lowest limit, though it was not the employers' intention to aim at the standard of living of the workers.

Current Business.

There has been a distinct shortage of prompt orders on the steam coal market during the past week, and the tone all round is easy. Stocks of all grades are excessive, and prices remain at the minima. There has been a certain amount of speculation as to whether some of the minima prices under the schedule will be reduced, more especially those relating to the best large qualities; but, so far, no official information has been forthcoming. Coke has moved off slightly better, but there is no change in patent fuel. Pitwood has been steadier owing to reduced supplies being brought forward.

LAUNCHES AND TRIAL TRIPS.

BOTH, steamship; built by Netherland Shipbuilding Company, to the order of N.V. Koninklijke Paketvaart-Maatschappij, Amsterdam; dimensions, 94·93 m. by 14·22 m. by 8·81 m.; to carry passengers and cargo. Engines, double compound "Lentz;" constructed by Gebr. Stork and Co., Hengelo (O.); trial trip, July 2nd.

KOSMOS II., whaling factory ship; built by Workman, Clark (1928), Ltd., to the order of Hvalfangerselskapet Kosmos II. A/S, Sandefjord; dimensions, 580 ft. by 77ft. by 53ft. Engines, quadruple-expansion, pressure 250 lb. per square inch; constructed by the builders; trial trip, July 8th.

PAN BOLIVAR, single-screw steamship; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of the Pan American Petroleum and Transport Company; dimensions, 483ft. by 65½ft. by 36½ft.; to carry oil in bulk. Engines, triple-expansion, pressure 220 lb. per square inch; constructed by Wallsend Slipway and Engineering Company, Ltd.; trial trip, July 8th.

WHITWORTH SOCIETY.—The summer meeting of the Whitworth Society took place at Sheffield on Tuesday, July 7th, and was well attended. Professor F. C. Lea, O.B.E., of Sheffield University, the president-elect, had made admirable arrangements for visits to works and provided motor transport in Sheffield for the members. At 9.15 a.m. an exhibition of cutlery was given in the Applied Science Department of the University, and afterwards the research laboratories were inspected. The party went thence to the works of John Brown and Co., Ltd., where heavy forging operations were inspected, and other processes seen in the adjoining works of Messrs. Firth. Luncheon was served at the Grand Hotel, with Sir Henry Fowler, C.B.E., in the chair, and he installed the new president. After luncheon the party visited the works of Hadfields, Ltd. Particulars of the Society may be obtained from the Hon. Secretary, Whitworth Society c/o the Institution of Mechanical Engineers, Storey's-gate, Westminster, S.W. 1.

THE SOCIETY OF CHEMICAL INDUSTRY.—In celebration of its jubilee, the Society of Chemical Industry has issued a special number of its *Journal* at the price of ten shillings. It is a very interesting production, the outstanding feature of which takes the form of brief biographies, with portraits, of the notable men who have been or are still connected with the Society, as Presidents, Councillors and Medallists. A portrait of Sir Henry Roscoe, taken in 1914, the first President of the Society, is given the place of honour on the frontispiece and is faced by one of Sir Harry McGowan, the present President. Amongst the others figure all the men famous in the chemical world during the past fifty years. This method of celebrating the great landmarks in their histories may be commended to the attention of other societies. These biographies and historical notes fill the first half of the volume, the remainder of which is occupied by reprints of notable papers and addresses read before the Society, beginning with Sir Henry Roscoe's presidential address of 1881. In offering the Society our heartiest congratulations on its jubilee we desire to felicitate it on the admirable method of celebrating that event which it has adopted in this special issue of its *Journal*.

INDUSTRIAL EFFICIENCY AND UNEMPLOYMENT.—"Scheme for Creating Efficiency in Industry and Reducing Unemployment" is the title of a pamphlet which we have just received from the author, Mr. James B. M'Gillivray. The crux of the "scheme" is the creation of a Central Board, upon which the Government, employers, trades unions and banking, insurance and accounting interests would be represented. This Board would control national rationalisation and help industries financially to effect reorganisation. Proposals put before it for approval would provide for the supply of plant for payment over a period of years, and it would be a condition of the supply of such plant that the purchaser would have an interest in the purchases from the commencement—for example, he would have to pay 20 per cent. of the contract price. It is suggested that the Government should guarantee 50 per cent., an insurance company 20 per cent., and the manufacturer 10 per cent., the remainder, as noted above, being met by the purchaser. "The extent to which the scheme would affect unemployment would naturally depend upon the volume of work done, and that in turn would depend upon the extent of guarantee given by the Government. Assuming that the scheme were to run for ten years, and that an amount of £10,000,000 was guaranteed for that period, allowing the contracts given out on the tenth year to be gradually liquidated, a total amount of work could be undertaken of £100,000,000. That would give direct employment to about 40,000 men continuously over the ten years, and a reducing number for the few succeeding years."

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	16/- to 20/6
(1) Spanish	14/-
N.E. COAST—	
Native	18/- to 21/-
Foreign (c.i.f.)	15/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 10 0	—
No. 1 Foundry	3 13 6	—
No. 3 Foundry	3 11 0	—
N.E. COAST—		
Hematite Mixed Nos.	3 2 0	3 2 0
No. 1	3 2 6	3 2 6
Cleveland—		
No. 1	3 1 0	3 1 0
Siliceous Iron	3 1 0	3 1 0
No. 3 G.M.B.	2 18 6	2 18 6
No. 4 Foundry	2 17 6	2 17 6
No. 4 Forge	2 17 0	2 17 0
Mottled	2 16 6	2 16 6
White	2 16 6	2 16 6
MIDLANDS—		
(c) Staffs.—	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 1 0	—
„ „ Foundry	3 6 0	—
(c) Northampton—		
Foundry No. 3	3 2 6	—
Forge	2 17 6	—
(c) Derbyshire—		
No. 3 Foundry	3 6 0	—
Forge	3 1 0	—
(3) Lincolnshire—		
No. 3 Foundry	—	—
No. 4 Forge	—	—
Basic	—	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	3 15 6 (*a*) / 4 0 6 (*b*) / 4 5 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 5 0	—
Common Bars	10 10 0	—
Best Bars	11 0 0	—
Double Best Bars	11 10 0	—
Treble Best Bars	12 0 0	—
LANCS.—		
Crown Bars	9 15 0	—
Second Quality Bars	8 5 0	—
Hoops	12 0 0	—
S. YORKS.—		
Crown Bars	10 0 0	—
Best Bars	10 15 0	—
Hoops	12 0 0	—
MIDLANDS—		
Crown Bars	9 5 0 to 10 7 6	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	8 10 0 to 9 0 0	—
Gas Tube Strip	10 12 6	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates (Marine)	10 10 0	10 10 0
„ „ (Land)	10 10 0	10 0 0
Ship Plates, ¼in. and up	8 15 0	7 15 0
Sections	8 7 6	7 7 6
Steel Sheets, ¼in.	7 10 0 to 7 15 0	8 0 0
Sheets (Gal. Cor. 24 B.G.)	11 7 6	10 0 0 to 10 5 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 15 0	7 15 0
Angles	8 7 6	7 7 6
Boiler Plates (Marine)	10 10 0	—
„ „ (Land)	10 0 0	—
Joists	8 15 0	7 7 6
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	—
Billets	6 10 0 to 9 0 0	—
MANCHESTER—		
Bars (Round)	9 7 6	—
„ (Small Round)	6 10 0	—
Hoops (Baling)	10 0 0	9 15 0
„ (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
„ (Lancs. Boiler)	9 0 0	—
SHEFFIELD—		
Siemens Acid Billets	9 2 6 (basis)	—
Hard Basic	8 2 6 and 8 12 6	—
Intermediate Basic	6 12 6 and 7 2 6	—
Soft Basic	6 0 0	—
Hoops	9 10 0 to 9 15 0	—
Soft Wire Rods	7 15 0	—
MIDLANDS—		
Small Rolled Bars	6 7 6 to 7 0 0	—
Billets and Sheet Bars	5 0 0 to 5 15 0	—
Galv. Sheets, f.o.b. L'pool	9 17 6 to 10 5 0	—
(2) Staffordshire Hoops	9 10 0	—
(*d*) Angles	8 7 6	—
(*d*) Joists	8 15 0	—
(*d*) Tees	9 7 6	—
(*d*) Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 0 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14 f.o.b.	13/6 to 13/9
Block Tin (cash)	109 10 0
„ (three months)	111 5 0
Copper (cash)	33 11 3
„ (three months)	34 5 0
Spanish Lead (cash)	12 13 9
„ „ (three months)	12 17 6
Spelter (cash)	12 13 9
„ (three months)	13 6 3
MANCHESTER—	
Copper, Best Selected Ingots	36 0 0
„ Electrolytic	38 10 0
„ Strong Sheets	66 0 0
„ Tubes (Basis Price), lb.	0 0 10½
Brass Tubes (Basis Price), lb.	0 0 9½
„ Condenser, lb.	0 0 11½
Lead, English	13 17 6
„ Foreign	12 12 6
Spelter	13 0 0
Aluminium (per ton—raw ingot)	£85

FERRO ALLOYS.

Tungsten Metal Powder	1/11½ per lb.
Ferro Tungsten	1/8½ per lb

	Per Ton.	Per Unit.
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£21 0 0	7/-
„ „ 6 p.c. to 8 p.c.	£20 12 6	7/-
„ „ 8 p.c. to 10 p.c.	£19 17 6	7/-
„ „ Specially Refined		
„ „ Max. 2 p.c. carbon	£30 0 0	10/-
„ „ „ 1 p.c. carbon	£34 0 0	12/-
„ „ „ 0·70 p.c. carbon	£36 0 0	14/-
„ „ „ carbon free	9½d. per lb.	
Metallic Chromium	2/7 per lb.	
Ferro Manganese (per ton)	£11 0 0 for home	
„ „ „	£11 10 0 for export	
„ Silicon, 45 p.c. to 50 p.c.	£10 10 0 scale 5/- per unit	
„ „ 75 p.c.	£15 0 0 scale 7/- per unit	
„ Vanadium	12/9 per lb.	
„ Molybdenum	4/2 per lb.	
„ Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£170	
Ferro Cobalt	9/- per lb.	

FUELS.

SCOTLAND.

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	13/6
„ „ Ell	14/-
„ „ Splint	14/6 to 16/-
„ „ Trebles	12/-
„ „ Doubles	11/6
„ „ Singles	10/6 to 10/9
AYRSHIRE—	
(f.o.b. Ports)—Steam	12/9
„ „ Jewel	17/-
„ „ Trebles	12/-
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	10/6 to 12/6
Screened Navigation	16/6 to 17/6
Trebles	12/- to 13/-
Doubles	11/6
Singles	10/9
LOTHIANS—	
(f.o.b. Leith)—Best Steam	11/-
Secondary Steam	10/6
Trebles	12/-
Doubles	12/-
Singles	10/6 to 10/9

ENGLAND.

(8) N.W. COAST—	
Steams	20/-
Household	30/- to 51/-
Coke	20/- to 20/6
NORTHUMBERLAND—	
Best Steams	13/6
Second Steams	12/-
Steam Smalls	7/6 to 8/-
Unscreened	12/6 to 13/-
Household	27/- to 39/-
DURHAM—	
Best Gas	14/6
Second	13/3 to 13/6
Household	25/- to 37/-
Foundry Coke	24/-

SHEFFIELD—	Inland.	
Best Hand-picked Branch	24/6 to 25/6	—
Derbyshire Best Bright House	19/- to 20/-	—
Best House Coal	18/6 to 20/-	—
Screened House Coal	17/- to 18/-	—
„ „ Nuts	14/6 to 15/-	—
Yorkshire Hards	15/- to 16/6	—
Derbyshire Hards	15/- to 16/6	—
Rough Slacks	8/6 to 9/6	—
Nutty Slacks	6/- to 7/6	—
Smalls	4/- to 5/6	—
Blast-furnace Coke (Inland)	12/3 on rail at ovens	
Furnace and Foundry Coke (Export), f.o.b. 14/- to 15/-		

(9) SOUTH WALES.

CARDIFF—	
Steam Coals :	
Best Smokeless Large	20/-
Second Smokeless Large	18/9 to 19/9
Best Dry Large	18/6 to 19/3
Ordinary Dry Large	17/9 to 18/-
Best Black Vein Large	18/3 to 18/9
Western Valley Large	18/- to 18/6
Best Eastern Valley Large	17/9 to 18/-
Ordinary Eastern Valley Large	17/9 to 18/-
Best Steam Smalls	13/6 to 14/-
Ordinary Smalls	11/- to 13/-
Washed Nuts	18/- to 21/-
No. 3 Rhondda Large	19/9 to 20/3
„ „ Smalls	15/- to 16/-
No. 2 „ Large	17/- to 17/3
„ „ Through	15/6 to 16/-
„ „ Smalls	14/- to 14/3
Foundry Coke (Export)	22/- to 36/6
Furnace Coke (Export)	16/6 to 17/6
Patent Fuel	20/- to 20/6
Pitwood (ex ship)	21/6 to 22/-
SWANSEA—	
Anthracite Coals :	
Best Big Vein Large	35/- to 37/6
Seconds	27/- to 31/6
Red Vein	22/6 to 27/6
Machine-made Cobbles	41/6 to 45/-
Nuts	40/- to 46/-
Beans	24/9 to 28/3
Peas	21/- to 21/9
Breaker Duff	8/6 to 9/6
Rubbly Culm	8/6 to 9/-
Steam Coals :	
Large	20/- to 20/6
Seconds	18/- to 20/-
Smalls	11/6 to 13/-
Cargo Through	16/- to 17/6

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate : Joists (minimum), 22/6 ; Ordinary Ship, Bridge, and Tank Plates and Sections, 15/- if home consumers confine purchases from associated British Steel Makers. (*e*) Delivered Black Country Stations.

French Engineering Notes.

(From our own Correspondent in Paris.)

The Coal Trade.

A STRIKE at the French collieries was only averted a short time ago by the Government promising to see what could be done to protect the home industry from the competition of imported coal and thereby enable coalowners to obtain higher prices and keep the men employed at present wages. The proposals of the coalowners and men were examined by the Commission of Mines in the Chamber of Deputies, which decided to introduce a Bill for the institution of import licences for coal; but as Parliament was prorogued before that could be done the colliers became troublesome. Their fears have now been allayed by the Government announcing that it intends to adopt most of the recommendations. The railway companies have already been invited to restore the specially reduced railway rates for coal from the northern collieries to the Channel and Atlantic ports, which rates were withdrawn two or three years ago after a trial, when it was found that they involved a loss to the railway companies without corresponding benefit to the coalowners. Instructions are being given to the public services and railway companies to employ French coal wherever possible, which will, it is estimated, increase the consumption of home fuel by about two and a-half million tons a year. A system of import licences is to be introduced in order to limit the importation of coal to just enough to meet the home deficit. The idea is to bring about an adjustment by inducing the French coalowners to diminish production, while the imports will be reduced by something like 20 per cent. A general scheme of coal distribution throughout the country is also being examined. Some of these protective measures do not require parliamentary sanction, but others do, and the import licence scheme cannot be put into force except by arrangement with some countries that have commercial agreements with France. The sanction of Belgium, for example, must be obtained, and Belgium looks to France as its principal export market. One-half of the Dutch coal output is sent to this country, and in order to prevent German coal from going into the northern colliery districts there is an agreement between Ruhr coalowners and the French Government whereby a maximum of 100,000 tons of coal is sent monthly to Strasburg for distribution by a State Commission. As the trouble in the French coal trade is due largely to what is alleged to be a dumping of fuel from such countries as Poland and Russia, it is probable that the licence scheme will be applied in a manner to check the importation of coal that is offered at abnormally low prices.

Rolling Stock.

The annual report of the Chambre Syndicale of Railway Rolling Stock Builders contains an indictment of the Government's policy to suspend the five years' buying programme in accordance with the recommendation of the Superior Railway Council to cut expenditure as a means of enabling the railway companies to emerge from their critical financial embarrassments. The five years' plan was intended to ensure regular work to locomotive and wagon builders, who would thus be able to organise the industry in a way to keep specialised labour employed in all the various departments and thereby conduce to economy and efficiency and remove any excuse on the part of the railway companies to purchase rolling stock abroad because home builders were unable to effect early deliveries at times when accumulations of orders were placed on the market. Builders arranged to help the railway companies to distribute orders regularly by forming a financial company which would enable the industry to grant them long credits. Rolling stock firms therefore argue that there is no excuse for the Government to sanction the cut of 547 million francs out of the total of 1447 million francs which were to have been spent this year on locomotives and wagons. During the first five months of the present year coaches and trucks have been ordered to the value of 300 million francs, or less than a third of the total for the similar period of 1930. If this state of things is allowed to continue there is a likelihood, it is said, of 15,000 men being out of work at the end of the year. Complaints are also made of the imports of locomotives and wagons from Germany and Belgium, much of this being on account of German reparations, but, independently of these reparations, there has been a steady increase in the imports of rolling stock from Germany, largely owing to the supplies of solid-injection engine rail vehicles which are superseding the petrol rail motors built in France. The report deplores the heavy import duties on crude oil, which, until recently, deterred French makers from developing the solid-injection engine. Even in the colonies there has been an increasing importation of locomotives and wagons from other countries. It has become evident that colonial intercommunication will necessitate the adoption of unified types of rolling stock, and this matter is being investigated with the colonial administrations. French builders insist that they should have a monopoly of colonial orders, but they complain at the same time of the disability under which they are labouring with regard to wages, which have again risen during the past year, while in all other countries they have declined. Their only hope, they say, of meeting foreign competition is by a reduction of wages. The situation has been further aggravated by the threatened collapse of the International Wagon Cartel as the result of the refusal of the German State Railways to recognise the German Wagon Builders' Association, which has taken advantage of this exclusion to apply for the dissolution of the International Cartel.

Transatlantic Freights.

The North Atlantic shipping companies held a conference in Paris during the past week to discuss an organisation of services and particularly a reduction of first-class passenger charges, which it is hoped to apply to big iners like the "Berengaria" and "France," but this question gave rise to considerable discussion, and, although the principle of reducing first-class passenger rates was accepted, it seemed likely that it would be limited to those steamers that are withdrawn occasionally from the New York service for circular pleasure cruises.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

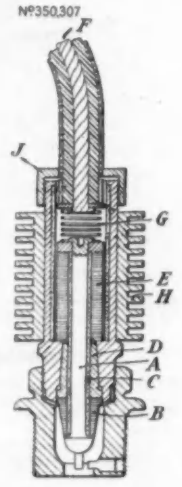
When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

INTERNAL COMBUSTION ENGINES.

N°350,307



350,307. July 23rd, 1930.—SPARKING PLUGS, Fabrica Italiana Magneti Marelli, 22, corso Venezia, Milan, Italy.

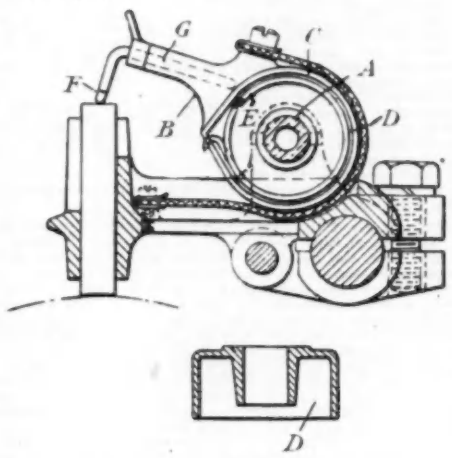
This ignition plug is intended to overcome the interference with wireless apparatus which may occur, say, on aeroplanes, when the return circuit of the current is carried only by the frame of the engine. The electrode A is insulated from its surroundings by the insulating materials B C D E, and is supplied with current from the core of the cable F through the spring G. The return current is taken by the case of the plug, through the air-cooled portion H, and the cap nut J, to the sheath of the cable. It is to be assumed that the sheath of the cable is connected directly with one of the terminals of the magneto.—*June 11th*, 1931.

DYNAMOS AND MOTORS.

350,356. September 30th, 1930.—BRUSH HOLDERS FOR DYNAMO-ELECTRIC MACHINES, *Westinghouse Electric and Manufacturing Company, of East Pittsburgh, Pennsylvania, U.S.A.*

The chief object of this invention is to provide an improved brush holder which will result in an increased life. The invention is particularly applicable to brush holders used on A.C. machines. The brush holder has a shaft A which supports a brush holder finger B, having an enlarged hub C which is mounted for movement around the shaft. The hub is provided with an annular recess D, which is open at one end and is adapted to house a helical spring E. The brush holder finger B is provided with a separate finger tip F, which bears against the top

N°350,356



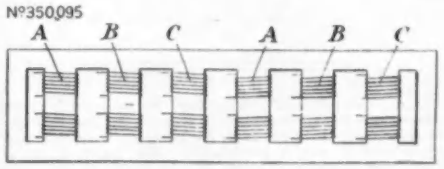
of the brush. The finger tip F is made of cadmium-copper, and is provided with a stem G which is embedded in the material of the rest of the brush holder finger which is cast around it. This brush holder finger material is preferably a silicon alloy of aluminium. The shaft A is made of graphitised "Micarta," or similar moulded composition, which is preferably prepared by mixing 10 gallons of a synthetic resin varnish with 22·5 lb. of graphite. The mixture is then thinned with a solvent, such as a mixture of alcohol and benzol. Cloth, such as cambric or 8 oz. duck, is then passed through a vat containing the resulting mixture. The impregnated cloth is finally dried, wrapped around a mandrel and moulded, under heat and pressure, to harden the composition.—*June 11th*, 1931.

TRANSFORMERS AND CONVERTERS.

350,095. March 26th, 1930.—ELECTRICAL TRANSFORMERS, Johnson and Phillips, Ltd., of Charlton, London, S.E. 7, and Harold Morgan Lacey, of 18, Burland-road, London, S.W. 11.

In accordance with this invention the sequence of the phase

N°350,095

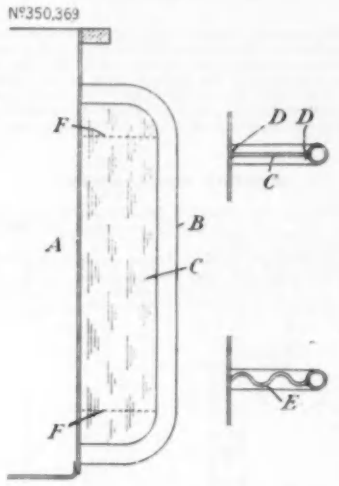


windings is so arranged that at no time does any part of the yokes carry more than one-half of the maximum flux in any one limb. Such a transformer combines the advantage of reduced core length, due to the division of each phase winding into two or more parts, with the reduction of yoke height, owing to the yoke carrying only half of the maximum core flux. In accordance with the arrangement shown, the total winding of each phase is divided into two parts, A A, B B, C C. In this case these parts are either wound or connected in an opposite sense to one another, and the phase sequence of arranging the parts on the limbs of the transformer is A B C A B C. In the case where the total winding of each phase is divided into three parts, the phase order of arranging the parts will be A B C A B C A B C, and the middle part A will be wound or connected in the opposite sense to the end parts A, and the same will apply to the parts B and to the parts C. The lower windings shown in the diagram are secondary windings.—*June 11th*, 1931.

350,369. November 13th, 1930.—TRANSFORMER AND SIMILAR TANKS, The English Electric Company, Ltd., 28, Kingsway, London, W.C. 2, and William Edward Milton Ayres, of Siemens Works, Stafford.

The object of this invention is to increase the radiating surface of transformer tanks. The tank and cooling tube are represented by A and B respectively. A sheet metal web or fin C is arranged to fill the space between the tank and tube, and is joined to each at its edges—for example, by welding,

N°350,369



as shown at D. The plate C is of such thickness that there is no appreciable temperature gradient across it, and the heat radiating surface may be still further increased by corrugating the plate, as shown at E. Whilst it may be desirable to make the plate fill the space between tank and tube completely, and to weld all four edges of the plate to the tank and tube, it may be desirable to avoid filling in the bend of the tube, and particularly when the corrugated plate is used. The plate is then preferably cut short, as shown by the dotted lines F.—*June 11th*, 1931.

TRANSMISSION OF POWER.

350,087. March 22nd, 1930.—MEANS FOR SUPPORTING ELECTRIC CABLES, W. T. Henley's Telegraph Works Company, Ltd., of 11, Holborn-viaduct, E.C. 1, and Ernest Moor, of "Medway," Sole-street, Cobham, Kent.

The method of supporting cables in accordance with this invention is more or less obvious from the drawing. Supporting means are provided by the use of one or more frame members of channel section, having a row of perforations in each side wall, in combination with cable holding members which are adapted to be connected to the channel members in appropriate positions by means of the perforations. The frame members may be used as separate units, mounted, for example, on a wall or other surface, or they may be combined together to form brackets or frames. A row of perforations in the base of the channel may assist in the fixing and interconnection of the frame members, and corner pieces may be used to join together two members of a frame. The cable-holding members are attached

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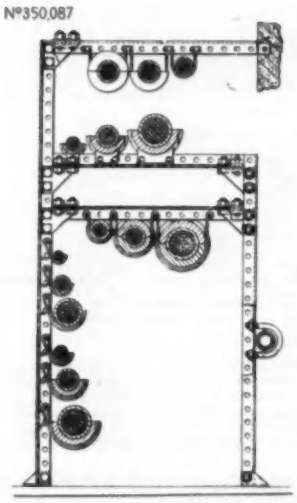

conveniently to the frame members by pins adapted to pass through similarly-placed holes in the two sides of a channel, the pins having a head at one end and means at the other end to prevent accidental withdrawal. One type of fitting which may be secured by a pin is a hanging bracket, having a semi-circular lower portion to carry the cable, and a portion in the form of a loop through which the pin can pass. The end of the bracket may bear against the base of the frame member to hold the bracket in place. A number of these brackets can be used, one above the other, and may be of different sizes. Another type of fitting which can be used with pins consists of a clip having a semi-circular portion and two straight side extensions, each of which is bent over at the end to form an eye to receive a pin. Such a clip may serve as a hanger or may be used in other positions. Various forms of cable-holding members constructed in accordance with the invention are illustrated.—*June 11th*, 1931.

350,349. September 19th, 1930.—ROLLER BEARINGS, *H. N. Skerrett*, 24, *Temple-row, Birmingham*.

This roller bearing is of the Timken type, with tapered rollers, and has the merit of being self-aligning. It will be noticed that the rollers have, besides their usual tapered profile, a mid portion which is hollowed with a circular curvature. This curved part

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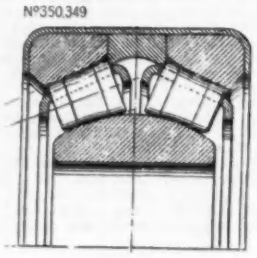

rides on the inner race, which is also curved to a spherical form, but its radius of curvature is slightly less than that of the hollows of the rollers, so that the rollers and the inner race make approximately point contact. The tapered ends of the rollers make parallel contact with the conical faces of the outer races. The races are consequently free to move angularly in relation to one another without impairing the bearing qualities of the rollers.—*June 11th*, 1931.

MINING MACHINERY.

350,318. August 5th, 1930.—YIELDING PIT PROPS, Vereinigte Stahlwerke Aktiengesellschaft, Stahlhaus 69, Brietstrasse, Düsseldorf, Germany.

This is an invention concerned with steel pit props which will yield under increasing pressure without damage to any important part. The prop comprises a base member A of channel section, and a top B of I section. The two are nested together, to make

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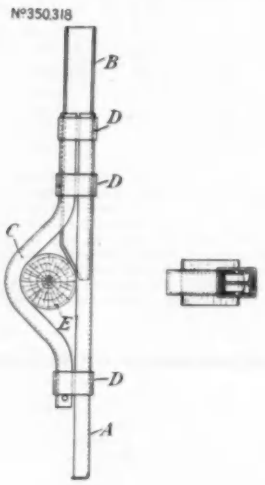

a column, with the assistance of the curved section C and the clamps D D D. Between the tapered end of the top of the prop and the bight of the bent piece there is inserted the piece of rough timber E. The pressure on this timber takes the load and is gradually relieved as the timber is crushed. It is a simple matter to knock off the clamps and re-set the prop for further use.—*June 11th*, 1931.

MACHINE TOOLS AND SHOP APPLIANCES.

350,304. July 22nd, 1930.—HACK SAWS, C. H. Crispin, 21, Lebanon-gardens, Wandsworth, London, S.W. 18.

This invention is a device for using up broken hack saw blades, which have lost the eye-holes at the end, and consequently cannot be fixed in the ordinary frame. The inventor provides a fitting, shown at A, which is cranked and provided with two

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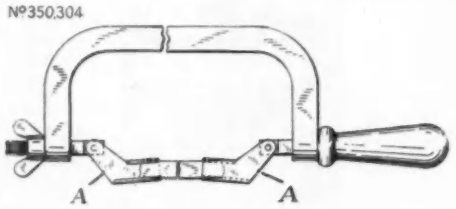

overturned flanges to hold the broken hack saw. The act of tightening up the saw in the frame jams the blade in the fitting and holds it without the help of the eye-hole. The inventor does not mention anything about the advisability of using the fittings as shown in the drawing, or reversed, so that the saw would be above the pins and consequently less liable to overturn in service.—*June 11th*, 1931.

350,360. October 4th, 1930.—A PROCESS FOR THE PRODUCTION OF SEAMLESS TUBES, Mannesmannröhren-Werke, 1b, Berger Ufer, Düsseldorf, Germany.

This invention comprises a process for the production of seamless tubes, which consists in rolling a hollow bloom—either a cast bloom or a bloom produced from the solid on a rolling mill—in a pilger rolling mill to form a prepared tube of relatively great length and thereafter expanding the prepared tube in a rolling mill in which the mandrel rod is arranged to be stressed under tension during the expanding operation. The process enables tubes of relatively large diameters and great lengths, for example, of approximately double the dimensions attainable by other rolling mill combinations, to be produced, with less wall thickness than has heretofore been possible. The prepared tube produced by the pilger rolling mill has the pilger head removed and, if necessary, may again be heated prior to being expanded in the tube expanding rolling mill. Fig. 1 is a diagrammatic longitudinal sectional view of a rolling mill in which oblique rollers are employed to roll a solid bloom into an initial hollow bloom. Fig. 2 is a diagrammatic longitudinal sectional view of a pilger rolling mill in which a hollow bloom produced, for example, in the manner illustrated in Fig. 1 is shown in the process of being pilgered out. Fig. 3 illustrates the step in the process according to this invention in which the bloom is expanded in

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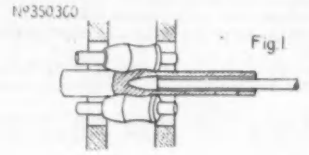

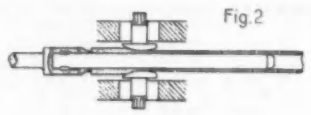

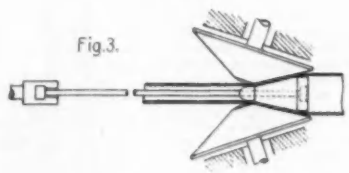

an oblique disc rolling mill arranged to stress the mandrel thereof under tension.—*June 11th*, 1931.

MISCELLANEOUS.

349,663. March 7th, 1930.—ELECTRO-MAGNETIC VALVES, Joseph Leslie Musgrave, 43, Bloomsbury-square, London, W.C. 1, and Richard Crittall and Co., Ltd., of the same address.

The automatically-controlled valve described in this specification is arranged to open and close under predetermined conditions, and the invention refers to that class of valve operated magnetically, more particularly in conjunction with a thermostat. A represents the valve proper, the head of which is shaped like a truncated cone, provided with a cavity B in the base so as to form a central internal part C. This central part normally rests in a correspondingly shaped fitting D, provided in the interior of the body or casing E of the valve. By operating the spindle F the lift of the valve can be regulated, or the valve A closed mechanically. A rib or projection G may be provided on opposite sides of the casing E, the ribs fitting into corresponding grooves formed in the sides of the valve proper to act as guides as the valve is lifted against its seating when being closed either magnetically or mechanically. The spindle H of the valve proper A is connected to the iron core J of the electro-magnet K, and when the core is magnetised it lifts the valve against a conical seating L, formed in the opening in the upper portion of the casing.—*June 4th*, 1931.

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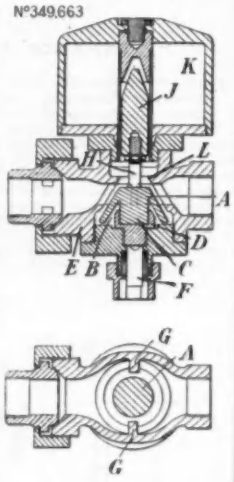

350,070. March 17th, 1930.—MERCURY VAPOUR RECTIFIERS, The Gramophone Company, Ltd., of Hayes, Middlesex; and Raymond Bainbridge Morgan, of 5, Cambridge-road, Hove, Sussex.

According to this invention, in a mercury vapour rectifier having a solid cathode adapted to be heated to a temperature at which electron emission takes place, means are provided whereby a steady magnetic field may be applied substantially at right angles to the path of the discharge. The effect of the magnetic field is to increase the current-carrying capacity of the rectifier and a small tube may be used. The scheme also allows the anode voltage to be kept low, with the result that there is less danger of disintegration of the filament coating and the life of a tube is prolonged. The use of a magnetic field has been found to have a protective effect on the anode, with the result that the latter does not become red hot through the bombardment of electrons from the cathode in spite of the increased current density of the rectifier. The drawing shows a mercury vapour rectifying tube comprising a container of glass, quartz or other suitable material enclosing a helical filament A, surrounded by and located coaxially with a cylindrical metallic anode B. The rectifying tube is adapted to be arranged between the poles of a permanent horseshoe magnet C in such a manner that the magnetic flux due to the poles of the magnet passes in a direction substantially at right angles to the path of the discharge occurring between the filament A and the cylindrical anode B. It will be clear that, instead of employing a permanent magnet, an electro-magnet may be provided for establishing the magnetic field across the discharge space.—*June 11th*, 1931.

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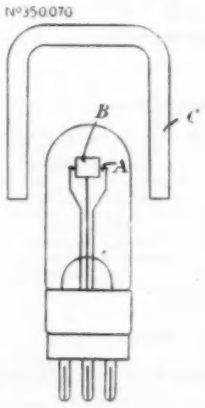

"STAHL UND EISEN."—We have received from Verlag Stahleisen m.b.H., of Düsseldorf, a copy of the special issue of *Stahl und Eisen*, which has been printed in order to commemorate the fiftieth year of publication. The paper, it may be recalled, was founded in 1881 as the organ of the Verein Deutscher Eisenhuttenleute, and it first appeared as a monthly journal. After ten years it was decided to publish fortnightly, but in 1907 a weekly issue was begun. The present issue gives some interesting accounts of those engineers who helped to build up the paper, and it will, we are sure, be widely appreciated in many lands.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

INSTITUTION OF MECHANICAL ENGINEERS.—Summer meeting at Cambridge. For programme see page 10 *ante*.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—South Midland District meeting at Acton. Meet at Council offices, Winchester-street, Acton, W. 3. 2.15 p.m.

TO-DAY AND SATURDAY, JULY 18TH.

SOCIETY OF CHEMICAL INDUSTRY.—Jubilee Celebrations. For provisional programme see page 471, Vol. 151.

TUESDAY, JULY 21ST.

OLD CENTRALIANS.—Devereux Restaurant, Devereux-court, Strand, W.C. 2. Luncheon. 1 p.m.

WEDNESDAY, JULY 22ND.

INSTITUTION OF CIVIL ENGINEERS: YORKSHIRE ASSOCIATION.—Visit to Mersey Tunnel. 2 p.m.

SATURDAY, JULY 25TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS: NORTH-EASTERN DISTRICT.—Visit to Synthetic Ammonia and Nitrates, Ltd., Billingham. 11 a.m.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS: SOUTH-EASTERN DISTRICT.—Meeting at Hastings. Assemble at Town Hall 11.30 a.m.

TUESDAY, JULY 28TH.

CRYSTAL PALACE SCHOOL OF PRACTICAL ENGINEERING.—Lecture Room at the School, Crystal Palace; 176th Award of Certificates. 3 p.m.

SUNDAY TO SATURDAY, SEPTEMBER 6TH TO 12TH.

INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS.—Congress at Zürich.

THURSDAY TO SATURDAY, SEPTEMBER 10TH TO 26TH.

SHIPPING, ENGINEERING AND MACHINERY EXHIBITION.—Olympia, W. Daily, 11 a.m. to 9 p.m.

SATURDAY TO WEDNESDAY, SEPTEMBER 12TH TO 16TH.

INTERNATIONAL FOUNDRY CONGRESS.—Milan.

SATURDAY TO SUNDAY, SEPTEMBER 12TH TO 27TH.

INTERNATIONAL FOUNDRY EXHIBITION.—At Milan.

SUNDAY TO FRIDAY, SEPTEMBER 13TH TO 18TH.

INSTITUTE OF METALS.—Autumn meeting at Zürich.

FRIDAY TO SUNDAY, SEPTEMBER 18TH TO 20TH.

NATIONAL SMOKE ABATEMENT SOCIETY.—Annual Conference at Liverpool.

TUESDAY TO FRIDAY, SEPTEMBER 29TH TO OCTOBER 2ND.

IRON AND STEEL INSTITUTE.—Autumn Meeting at Swansea.

CONTRACTS.

THE BRITISH THOMSON-HOUSTON COMPANY, Ltd., has received an order from the Port of London Authority for three months' supply of "Mazda" vacuum and gas-filled lamps.

MIRRLEES, BICKERTON AND DAY, Ltd., of Stockport and Westminster, have received orders for Diesel oil engines ranging from 50 H.P. to 600 H.P. from the Natal Technical College, Durban; the L.C.C. School of Engineering and Navigation, Poplar; The Alexandria Water Company, Ltd., Egypt; the Madras and Southern Mahratta Railway Company; the Stone and Webster Engineering Corporation, Boston, U.S.A., for Jamaica; the Panama Corporation; the Federated Malay States; Trinidad; Chanpatia, India; Colombo; the West Sussex County Mental Hospital, Chichester; and for Burhanpur, the Mhow Electric Supply Company, Nadiad, Peshawar, and Monghyr, all in India.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

ASTER LTD., of 86, Strand, has removed its offices to Dering House, Dering-street, London, W. 1. Telephone number, Mayfair 4131; telegraphic address, "Asterenge, Phone, London."

LEYLAND MOTORS, Ltd., of Leyland, Lancashire, asks us to announce that it has appointed Mr. M. R. Pease as sales manager to fill the vacancy caused by the death of Mr. A. W. Windsor. Mr. Pease will be succeeded as service manager by Mr. G. Finch.

SAMUEL HODGE AND SONS, Ltd., of 130-132, Leadenhall-street, London, E.C. 3, ask us to announce that they have taken over all business connections of the Howden-Buell Combustion Company, Ltd., with all rights and interest in the Howden-Buell system of pulverised coal-firing, the British Rema pulverising mills and vacuum system and other engineering specialities with which it is connected.

IMPERIAL AIRWAYS, Ltd., will move to its new head office and London terminus on July 27th, 1931. The address will be Airway Terminus, Victoria Station (Continental Department), London, S.W. 1. Telephone, Victoria 2211; telegrams, "Impairlim, London." The present office at Airways House, Charles-street, will be retained as a West End branch passenger and freight booking office and inquiry bureau. The car services between London and Croydon will run from Airway Terminus, Victoria.

CONVERSION OF FOUR-WHEELED LORRIES.—Owing to the extra pay-load which a six-wheeled as compared with a four-wheeled lorry can carry, a number of owners of "Sentinel" four-wheelers have had them converted into rigid six-wheelers, the existing rear axle being replaced by a twin axle four-wheeled bogie. On this new bogie both the axles which carry the wheels are supported in spherical bearings in the arms which pivot on the third or centre axle to which the springs are anchored. A brake drum is attached to each of the four rear wheels and of the sixteen brake shoes eight are applied by a hand ratchet lever and the other eight by steam cylinders controlled by a pedal in the driver's cab. In these conversions, which are carried out at Shrewsbury and are sound engineering jobs, the rear bogie is fully compensated and complies with the latest road regulations for six-wheeled vehicles.